



**Department of
Transportation**

I-81 VIADUCT PROJECT - PHASE 1, CONTRACT 1

PIN 3501.90, Contract D900054

DB CONTRACT DOCUMENTS REQUEST FOR PROPOSALS PART 8

SPECIAL SPECIFICATIONS

Draft May 17, 2022

This *Part 8 – Special Specifications* provides access to, and details the Project-specific requirements for the use of, the following documents:

1. NYSDOT Standard Specifications and Construction Materials
2. NYSDOT Engineering Information Issuances
3. NYSDOT Special Specifications.

NYSDOT Standard Specifications and Construction Materials

The Design-Builder shall use the NYSDOT Standard Specifications Construction Materials in coordination with *Part 5 – Special Provisions*.

The NYSDOT Standard Specifications Construction Materials can be accessed at the following internet link:

<https://www.dot.ny.gov/main/business-center/engineering/specifications/busi-e-standards-usc>.

NYSDOT Engineering Information Issuances

The Design-Builder shall use the relevant NYSDOT engineering information issuances, which include:

1. Engineering Instructions (EI);
2. Engineering Bulletins (EB);
3. Engineering Directives (ED).

The above listed engineering information issuances can be accessed at the following internet link:

<https://www.dot.ny.gov/main/business-center/consultants/forms-publications-and-instructions/engineering-information-issuance-system>

NYSDOT Special Specifications

The Design-Builder *may* use NYSDOT Special Specifications which are listed in the Electronic Pay Item Catalog (e-PIC) and which have received General Approval, and **shall** use any NYSDOT Special Specifications which are referenced in this Part 8 or elsewhere in the Contract Documents. Delete and ignore sections in the NYSDOT Special Specifications titled *Method of Measurement* and *Basis of Payment* from the NYSDOT Special Specifications.

NYSDOT Special Specifications can be accessed at the following internet link:

<https://www.dot.ny.gov/main/business-center/engineering/specifications/special-specifications-us>.

The NYSDOT e-PIC may be accessed at the following internet link:

<https://www.dot.ny.gov/pic>

The following Special Specifications are attached herein:

ITEM 555.02XXXX01 – CONCRETE FOR STRUCTURES CLASS MP (MASS PLACEMENT)
ITEM 555.10000006 - ABANDON EXISTING CULVERT
ITEM 555.80020001 - CRACK REPAIR BY EPOXY INJECTION (RESTORATION)
ITEM 557.01040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE - BOTTOM FORMWORK REQUIRED
ITEM 557.11010003 - INTEGRAL PRECAST CONCRETE BARRIER
ITEM 557.2500NN16 - CRACK SEALING USING HIGH MOLECULAR WEIGHT METHACRYLATE – LINEAR CRACKS
ITEM 557.2600NN16 - CRACK SEALING USING HIGH MOLECULAR WEIGHT METHACRYLATE - FLOODING
ITEM 557.6601NN16 - ULTRA-HIGH PERFORMANCE CONCRETE (UHPC)
ITEM 564.20010008 – HOT-DIP GALVANIZING OF STRUCTURAL STEEL
ITEM 572.0002NN01 - METALIZING
ITEM 603.0791XX06 - EXTENSION OF EXISTING CULVERTS WITH CORRUGATED STEEL PIPE - PAVED INVERT
ITEM 607.99620010 - NOISE BARRIER SYSTEM (HIGHWAYS)
ITEM 611.190X0024 - POST-PLANTING CARE WITH REPLACEMENT
ITEM 634.99010017 – BUILDING CONDITION SURVEY
ITEM 634.99020017 – VIBRATION MONITORING (NONBLASTING)
ITEM 637.4000NN20 - WEBCAM SYSTEM
ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN
ITEM 680.80325010 – ALUMINUM MICROCOMPUTER CABINET BASE
ITEM 680.94997008 – FURNISH AND INSTALL ELECTRICAL DISCONNECT/ GENERATOR TRANSFER SWITCH
ITEM 683.91150108 – MULTI LANE RADAR TRAFFIC DETECTOR
ITEM 683.96051804 – GALVANIZED CAST IRON SURFACE MOUNTED JUNCTION BOX WITH HINGED COVER, SURFACE MOUNTED, 18 IN (H) X 18 IN (W) X 12 IN (D)
ITEM 800.01000015 – DESIGN BUILD – DESIGN SERVICES
ITEM 800.02000015 – DESIGN BUILD – CONSTRUCTION INSPECTION SERVICES
ITEM 800.03000015 – DESIGN BUILD – QUALITY CONTROL SERVICES
ITEM 800.0400NN15 – DESIGN BUILD – EXTRA WORK
ITEM 800.05000015 – DESIGN BUILD – SITE MOBILIZATION
ITEM 800.06000115 – DESIGN BUILD – CONSTRUCTION WORK

In the event of a discrepancy between the version of any Special Specification attached herein and the version available from the NYSDOT web site listed above, the version included in these Contract Documents shall apply.

ITEM 555.02000001 - CONCRETE FOR STRUCTURES CLASS MP (MASS PLACEMENT)

DESCRIPTION:

Furnish and place portland cement concrete with a minimum compressive strength of 3000 psi where specified on the Plans for mass concrete placements of structural elements. Follow §555, except as noted below.

MATERIALS:

§555-2, except as modified herein.

Using materials meeting the requirements of §501-2.02 and as indicated below, design a concrete mixture(s) based on the following criteria.

- Strength - 56 day minimum compressive strength of 3000 psi.
- Slump - 3 inches +/- 1 inch. A high range water reducing admixture may be used upon prior written approval from the Director, Materials Bureau. If adding a high range water reducing admixture, slump will be limited to 3 inches maximum before the addition. After the addition, slump will be limited to 8 inches maximum.
- Entrained Air - 5 to 8%.
- Water/Total Cementitious Material Ratio - 0.40 maximum.
- Class F Fly Ash - 20% to 50% by weight of cementitious materials.
- Cement, Type II only.

Perform mix development testing in accordance with ASTM C143, C231, C192 and C39 to assure all performance criteria can be achieved during production and placement.

An equal mix design may be submitted for evaluation to the Director, Material Bureau for approval.

At least one month prior to the start of any concrete placement, provide a copy of the proposed mixture design(s) and trial batch test results to the Director, Materials Bureau, submitted through the Engineer, for evaluation. Submit sufficient data to permit the Director to offer an informed evaluation. Include at least the following:

- Concrete mix proportions.
- Material sources. Also include fineness modulus and specific gravity for all aggregates.
- Air content of plastic concrete.
- Slump of plastic concrete.
- Compressive strength at 7, 14, 28, and 56 days and at any other age tested or deemed necessary.

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- Temperature/time relation (Interior of concrete with autogenous curing boxes) for 7 days measuring at hourly intervals.

Do not interpret having a valid mixture design as approval of the mixture. Resubmit any proposed mixture design change to the Director, Materials Bureau, for evaluation. Multiple mixture designs may be used to address performance and placement issues as deemed necessary by the Contractor. Submit each mixture for evaluation, as indicated above, prior to use.

CONSTRUCTION DETAILS:

Follow §555-3, except as modified herein:

Replace §555-3.01 - Concrete Manufacturing and Transporting with:

- §501-2.03 - Concrete Batching Facility Requirements,
- §501-2.04 - Concrete Mixer and Delivery Unit Requirements,
- §501-3.02 - Handling, Measuring, and Batching Materials, and
- §501-3.03 - Concrete Mixing, Transporting, and Discharging, except that the maximum concrete temperature at the point of discharge shall be as specified in the Thermal Control Plan.

The Contractor shall prepare a Thermal Control Plan prior to placement of the mass concrete.

Thermal Control Plan:

The Thermal Control Plan shall at a minimum include a Heat Dissipation Study (Reference ACI 207 or thermal modeling software) as well as to describe the measures and procedures the Contractor intends to use to satisfy the following Temperature Control Requirements for each mass concrete element:

- i. The Maximum Temperature Differential shall be limited to 35 degrees F. The temperature differential between the interior and exterior portions of the designated mass concrete elements during curing will be maintained to be less than or equal to this Maximum Temperature Differential, and
- ii. The Maximum Allowable Plastic Concrete Temperature shall be limited to 160 degrees F.

A change to the Temperature Control Requirements specified above can be addressed in the Thermal Control Plan through Heat Dissipation Studies to demonstration that deleterious effects to the concrete can be avoided through adherence to the Thermal Control Plan. Such a change requires approval by the D.C.E.S.

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As a minimum, the Thermal Control Plan shall include the following:

- A. Concrete mix design. If the mix will be cooled, the Contractor shall define the methodology and necessary equipment to achieve these mix temperatures.
- B. Duration and method of curing.
- C. Methods of controlling temperature differentials, inclusive of active coolant systems not previously defined within the Engineering Drawings.
- D. An analysis of the anticipated thermal developments in the mass concrete elements for all expected project temperature ranges using the proposed mix design, casting procedures, and materials. It shall show complete details and determine the maximum temperature differentials within the concrete mass.
- E. Temperature sensor types and locations including installation details.
- F. Temperature Monitoring System including system description, operating plan, recording and reporting plan, and remedial action plan.
- G. Field measures and documentation procedures to ensure conformance with the maximum concrete temperature and temperature differential requirements.
- H. Field methods of applying immediate corrective action should the temperature differential approach the Maximum Temperature Differential and Maximum Allowable Concrete Temperature.

The Contractor shall submit the Thermal Control Plan to the Engineer for approval a minimum of thirty working days prior to concrete placement. Mass concrete placement shall not begin until the D.C.E.S. has approved the Thermal Control Plan.

Acceptance/Testing of concrete shall follow §555-3.04 C, meeting the specified requirements of this specification and the Thermal Control Plan.

Modify §555-3.06 - Concrete Joints: Structural elements may be constructed in stages using construction joints if permission is granted by the Deputy Chief Engineer for Structures Design and Construction.

Modify §555-3.10 - Loading Limitations: After the minimum curing period, concrete may receive construction loads after reaching a compressive strength of 2500 psi. Testing will be in

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accordance with Note 3 of Table 555-4.

All concrete for this item shall achieve 3000 psi prior to opening the structure to traffic. Compressive strengths shall be determined from cylinders stored and cured in the same manner as the concrete it represents. The average compressive strength of each cylinder set shall be greater than the desired compressive strength, with no individual cylinder less than 90% of the desired compressive strength.

Temperature Monitoring System:

The temperature monitoring and recording system for mass concrete shall consist of temperature sensors connected to a data acquisition system capable of printing, storing, and downloading data to a computer. Temperature sensors shall be located such that the maximum temperature difference within a mass concrete element can be monitored. As a minimum, concrete temperatures shall be monitored from the center of the concrete mass, the base of the mass, the surface of the mass, and the center of an exterior outer face that is the shortest distance from the center of the concrete mass.

Temperature readings shall be automatically recorded on an hourly basis or as required by the Engineer. A redundant set of sensors shall be installed near the primary set. Provision shall be made for recording the redundant set, but records of the redundant sensors need not be made if the primary set is operational.

Methods of concrete consolidation shall prevent damage to the temperature monitoring and recording system. Wiring from temperature sensors cast into the concrete shall be protected to prevent movement. Wire runs shall be kept as short as possible. The ends of the temperature sensors shall not come into contact with either a support or concrete form, or reinforcing steel.

When any equipment used in the temperature control and monitoring and recording system fails during the mass concrete construction operation, the Contractor shall take immediate remedial measures to correct the situation as specified in the Thermal Control Plan.

Temperature reading will begin when mass concrete placement is complete. Temperature readings will continue until the maximum temperature differential (not maximum temperature) is reached and a decreasing temperature differential is confirmed as defined in the Thermal Control Plan. Furnish a copy of all temperature readings daily.

If monitoring indicates that the temperature differential is approaching the maximum temperature differential of 35 degrees F, the Contractor shall take immediate corrective action as defined in the Thermal Control Plan to retard further increase of the temperature differential. The Contractor will make the necessary revisions to the approved Thermal Control Plan to satisfy the

ITEM 555.02000001 - CONCRETE FOR STRUCTURES CLASS MP (MASS PLACEMENT)

temperature control requirements on future placements. Revisions to the plans must be approved by the Engineer prior to implementation.

§555-3.13 - Damaged or defective concrete, applies with the following additions:

If mass concrete temperature differentials are exceeded, provide all analyses and test results deemed necessary by the D.C.E.S. for determining the structural integrity and durability of the mass concrete element, to the satisfaction of the D.C.E.S.. The Department will make no compensation, either monetary or time, for the analyses, tests or any impacts upon the project.

Any cracks in the structural element greater than 0.016 inches resulting from the contractor's inability to properly maintain concrete temperature differentials, shall be repaired using epoxy injection at no additional cost to the Department. The effectiveness of repairs shall be demonstrated by the contractor using evaluation methods acceptable to the Department. The Engineer-In-Charge will be responsible for accepting or rejecting the repairs after the field evaluation.

METHOD OF MEASUREMENT:

Cubic yards as per §555-4.

BASIS OF PAYMENT:

§555-5, including the cost of the mix design and Thermal Control Plan in the unit bid price per cubic yard

ITEM 555.10000006 - ABANDON EXISTING CULVERT

DESCRIPTION: This work shall consist of the abandonment and filling of existing culverts that are not removed under excavation items.

MATERIALS: Fill for abandoned culverts shall be a flowable mixture of sand, cement, fly ash, and water, with a 28 day compressive strength of 50 to 100 psi. Mix design shall be submitted to the Engineer for approval.

CONSTRUCTION DETAILS: Prior to filling operations, the Contractor shall remove and dispose of the existing end sections and clean the culvert of any materials that will restrict the flow of the fill material A.D.B.E.

Filling shall begin at the upstream location of the existing culvert to be abandoned.

Provide temporary bulkheads with air vents at the upstream and downstream ends of the culvert to be abandoned.

METHOD OF MEASUREMENT: The work of this item will be measured as the cubic yards of fill material placed within the culvert to be abandoned, based on Engineer approved batch delivery tickets. This quantity shall not exceed the theoretical interior volume of the culvert being abandoned.

BASIS OF PAYMENT: The unit price bid per cubic yard shall include all labor, material, and equipment necessary to complete the work. The cost of removing and disposing of the existing end sections, cleaning the culvert, any required excavation, sheeting, fill and applying water for compaction shall be included in the price bid for this item.

ITEM 555.80010001 - CRACK SEALING BY EPOXY INJECTION (PREVENTION)

ITEM 555.80020001 - CRACK REPAIR BY EPOXY INJECTION (RESTORATION)

DESCRIPTION: Install injection ports, seal the crack opening, inject the crack with epoxy (full depth for restoration work, or as deep as conditions allow for prevention work), and restore the sealed surface to a flush condition in areas visible to the public. Perform the work at locations indicated on the contract plans or where directed by the Engineer.

PREVENTION - use in contaminated, cracked concrete areas to prevent movement and protect reinforcing.

RESTORATION - use in uncontaminated cracked concrete areas to restore structural integrity. Take verification cores for payment. Have an experienced epoxy manufacturer representative present until the work is acceptable to the Engineer.

MATERIAL REQUIREMENTS:

1. Crack Sealant - epoxy paste that completely cures in 4 hours or less and retains the injected epoxy. Any other type of crack sealant is subject to a project demonstration and approval by the Engineer.
2. Low Viscosity Injection Epoxy - Manufacturer certified to meet ASTM C881, Type I or IV, Grade 1, Class B or C (as temperature conditions require.)
3. Vertical & Overhead Patching Material (Approved List) - (for ITEM 555.80020001) §701-08

INJECTION EQUIPMENT: Use equipment in good working order, as approved by the Engineer, with the following features:

- Separate feed lines to the mixing chamber
- Automatic mixing and metering pump
- Ability to thoroughly mix the epoxy components in the mixing chamber
- Operator control of the epoxy flow from the mixing chamber
- Clean, legible, accurate pressure gauges easily viewable by the operator
- Ability to provide an uninterrupted pressure head to continually force epoxy into the cracks
- Injection pressure from 0 to at least 200 PSI
- Capable of metering each epoxy component to within 3.0% of the epoxy manufacturer's mix ratio

Un-reacted epoxy components may be stored overnight in separate reservoirs and feed lines.

Before starting the work, demonstrate to the Engineer the ability of the equipment to meter and mix epoxy components to the required mix ratio. Ratio accuracy may be determined by simultaneously metering each component into separate, clean, accurately graduated, volumetric containers, or another procedure approved by the Engineer. Also, activate the automatic mixing and metering pump, mix a small amount of injection epoxy, and waste it into a disposable container. The Engineer will observe this trial operation and be satisfied the equipment is working properly, and the epoxy is mixed with no streaks.

CONSTRUCTION DETAILS:

ITEM 555.80010001 - CRACK SEALING BY EPOXY INJECTION (PREVENTION)
ITEM 555.80020001 - CRACK REPAIR BY EPOXY INJECTION (RESTORATION)

1. Crack and Surface Preparation. Remove all debris or contaminants accessible within the cracks by using hand tools, water blasting or oil-free high pressure air blasting, vacuuming, or other methods suitable to the Engineer. Epoxy resin will not penetrate: compacted, water or oil soaked debris. Allow free moisture within the crack to be absorbed before injecting epoxy. Remove all materials, including moisture, from the surface adjacent to the crack which might interfere with bonding of the crack sealant.
2. Injection Port Installation. Attach injection ports to the prepared surface by placing them onto (surface adapters) or into the cracks (socket ports) and affixing with crack sealant. Larger cracks may be ported by inserting an anchored tube into the crack.

Use positive connection port designs to connect injection equipment to the ports. Other injection port designs and attachment methods, where worker fatigue would not be a problem, require approval by the Engineer.

Use the following general guidelines for spacing injection ports when cracks are uniform in width through the structure. For cracks that get tighter with depth, double this spacing. Intermediate ports may be placed for observation. To permit maximum flow into the void, position ports on the wider crack sections and at intersections, rather than at an exact spacing.

If these guidelines cannot be followed, use port locations approved by the Engineer. Port spacing may be modified by the Engineer as experience is gained, or when cores are taken to determine penetration.

FOR CRACKS COMPLETELY THROUGH A MEMBER

- A. Cracks accessible from one side - space the ports not less than the thickness of the member.
- B. Cracks accessible from both sides - space the ports not less than twice the thickness of the member and stagger them relative to the ports on the opposite side. Make the stagger between ports (on opposite sides of the member) at least the thickness of the member.

Place the endmost ports at the ends of the crack so as to insure complete filling of the crack.

FOR MULTIPLE CRACKS ALL OVER A MEMBER.

Space the ports as far apart as practical, but not less than 8" from one another. An 8" spacing presumes a 4" penetration in each direction, if the adjacent ports are not plugged when epoxy reaches them. For fine cracks that taper to an end, place the endmost ports about 4" from the end.

3. Crack Seal. After port installation, seal the crack opening with crack sealant, being careful not to plug the injection ports. Allow the crack sealant to cure completely before injecting epoxy.

Apply crack sealant only when surface and ambient temperatures are above 50° F.

ITEM 555.80010001 - CRACK SEALING BY EPOXY INJECTION (PREVENTION)

ITEM 555.80020001 - CRACK REPAIR BY EPOXY INJECTION (RESTORATION)

4. Port Flushing. Prior to any epoxy injection, flush critical ports with oil-free compressed air to verify that air exits from all the installed ports, dry the cracks, and check for leaks.
5. Epoxy Injection. Perform epoxy injection only when the surface and ambient temperatures are above 45° F and are not expected to fall below 45° F during the next 24 hours.

UNIFORM WIDTH CRACKS - start toward the middle of a horizontal crack and work outward, or the lowest point of a sloping or vertical crack and work upward.

VARIABLE WIDTH CRACKS - start at the widest points of all types of cracks and work outward. Secure the feed line to the first port. Initiate and continue flow until epoxy exits from the adjacent port. (Plug observation ports and continue through the same port to achieve maximum penetration.) Temporarily stop the injection process, remove the feed line, and seal the port. Attach the feed line to the adjacent port and repeat this procedure along the crack until the last port is sealed.

Generally, use higher pressures when injecting narrow deep cracks, medium to low for wider cracks, and lowest pressures when injecting a delaminated area or an area susceptible to lifting. Low pressure applied for a longer duration is often more effective than high pressure applied for a shorter duration.

Replenish the epoxy supply in the mixing equipment before it is exhausted. Thoroughly stir each epoxy component both before and after adding it to its respective component in the mixing equipment. Exercise care to assure a continuous injection operation.

Allow the epoxy to fully cure prior to performing subsequent work in the repaired area.

In the event of leakage from a crack, stop the injection process until the leak is sealed. When any work stoppage exceeds 15 minutes, clean the mixing chamber and flush the line that carries mixed epoxy. Flush with a suitable solvent, followed by air.

6. For ITEM 555.80020001 CRACK REPAIR BY EPOXY INJECTION (RESTORATION), take cores ranging in diameter from 1 to 4", as approved by the Engineer, to verify full penetration by epoxy and its cure. Take a representative core from each structural element, or one from every 100 feet of crack repaired, whichever is greater, at locations approved by the Engineer. The Engineer will retain the cores and determine if they are acceptable for payment. Patch the holes with Vertical & Overhead Patching Material.

More than one core may be necessary to obtain an acceptable sample from cracks that diverge below the surface. (To avoid cutting reinforcing, the core drill may be angled to intercept a crack behind the reinforcing.)

7. Clean Up. In all areas visible to the public, as determined by the Engineer, remove spillage, the ports and crack sealant until flush with the adjacent surface. Remove stains and repair any damage to the satisfaction of the Engineer at no additional cost.

ITEM 555.80010001 - CRACK SEALING BY EPOXY INJECTION (PREVENTION)
ITEM 555.80020001 - CRACK REPAIR BY EPOXY INJECTION (RESTORATION)

METHOD OF MEASUREMENT: The Engineer will measure the work as the number of linear feet of crack sealed or repaired, as specified.

BASIS OF PAYMENT: Include the cost of all labor, materials, and equipment necessary to complete the work in the unit price bid per linear foot. For ITEM 555.80020001 CRACK REPAIR BY EPOXY INJECTION (RESTORATION), also include the cost of coring and repairing the core holes.

For ITEM 555.80010001 CRACK SEALING BY EPOXY INJECTION (PREVENTION), the Engineer will authorize payment after the measured length of crack has been sealed and the surface cleaned.

For ITEM 555.80020001 CRACK REPAIR BY EPOXY INJECTION (RESTORATION), the Engineer will authorize payment after the measured length of crack has been repaired as verified by cores, the core holes patched and the surface cleaned.

**ITEM 557.01040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE
SLAB WITH INTEGRAL WEARING SURFACE - BOTTOM FORMWORK
REQUIRED**

**ITEM 557.05040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE
SLAB WITH INTEGRAL WEARING SURFACE - BOTTOM FORMWORK
NOT REQUIRED**

**ITEM 557.07040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE
SLAB WITH SEPARATE WEARING SURFACE - BOTTOM FORMWORK
REQUIRED**

**ITEM 557.09040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE SLAB WITH
SEPARATE WEARING SURFACE - BOTTOM FORMWORK NOT REQUIRED**

DESCRIPTION. Furnish and place lightweight, high performance (Class HP) concrete to construct superstructure slabs as shown in the contract documents.

MATERIALS. Use materials meeting §557-2. Perform additional work as follows:

A. Design. Design a lightweight, high-performance concrete mixture, proportioned according to the American Concrete Institute Manual of Concrete Practice, ACI 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

1. Produce a homogeneous mixture of cement, pozzolan (Fly Ash or GGBFS), microsilica, fine aggregate, lightweight coarse aggregate, air entraining agent, normal range set-retarding, water-reducing admixture, and water, as designed.
2. Use Type I, I/II, II (§701-01) or Type SF (§701-03) cement. Use a minimum cementitious content of 675 lb/yd³. Use 15-20% pozzolan (§711-10, Flyash, or §711-12 GGBFS), and 6-10% microsilica (§711-11).
3. Use lightweight coarse aggregate conforming to §703-10, with a gradation in the 3/4 inch to No. 4 size designation in ASTM C330, Table 1.
4. Determine the cement content for each trial batch by means of a yield test according to ASTM C138.
 - a. At least 10 working days prior to concrete placement, provide the Materials Engineer with a copy of the trial mix design with the following data:
 - Fine and coarse aggregate (saturated, surface dry condition) content in lb/yd³.
 - Cementitious content in lb/yd³.
 - Water content in lb/yd³.
 - Unit weight of freshly mixed concrete in accordance with ASTM C138.
 - Dry unit weight in accordance with ASTM C567.
 - 28-day compressive strengths.
 - Batch quantities of all materials as they will appear on the batch record.
 - b. The Materials Engineer, or their representative, will approve the batch quantities prior to use. Use these values to manufacture all lightweight concrete for this project, and periodically correct the batch weights to account for changes in the fine aggregate fineness modulus and aggregate moisture contents in accordance with Materials Method 9.1, or current Department directives.

B. Stockpile Handling. Construct lightweight coarse aggregate stockpile(s) at the production facility so as to maintain uniform moisture throughout the pile. Continuously and uniformly sprinkle the stockpile(s) with water using a sprinkler system approved by the Materials Engineer. Soak for a minimum of 48 hours, or until the stockpile has achieved a

**ITEM 557.01040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE
SLAB WITH INTEGRAL WEARING SURFACE - BOTTOM FORMWORK
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**ITEM 557.05040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE
SLAB WITH INTEGRAL WEARING SURFACE - BOTTOM FORMWORK
NOT REQUIRED**

**ITEM 557.07040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE
SLAB WITH SEPARATE WEARING SURFACE - BOTTOM FORMWORK
REQUIRED**

**ITEM 557.09040018 - LIGHTWEIGHT, HIGH - PERFORMANCE SUPERSTRUCTURE SLAB WITH
SEPARATE WEARING SURFACE - BOTTOM FORMWORK NOT REQUIRED**

minimum internal moisture content of 15% by weight. If a steady rain of comparable intensity occurs, turn off the sprinkler system.

If the rain ceases prior to the end of the wetting period, restart the sprinkling system. At the end of the wetting period, or when a rainfall ceases beyond the end of the wetting period, allow stockpiles to drain for 12 to 15 hours immediately prior to use.

C. Sampling of Materials. The Materials Engineer's representative, will take a 1 liter sample of microsilica in accordance with Materials Method 9.1, or current Department directives, for each day's placement for testing. Sampling of other materials will be at the direction of the Regional Materials Engineer.

D. Batching. After the materials have been accepted for this work, determine the proportions for concrete and equivalent batch weights based on trials made with materials to be used in the work.

- If densified microsilica powder is used and added independently - weigh cumulatively in the following order: cement, fly ash (or GGBFS), then microsilica. Base the batching tolerance of $\pm 0.5\%$ on the total weight of cementitious material, for each material draw weight.

- If densified microsilica powder is used as part of blended cement - weigh cumulatively in the following order: blended cement, then fly ash (or GGBFS). Base the batching tolerance of $\pm 1\%$ on the total weight of cementitious material, for each material draw weight.

E. Compressive Strength Determination. Achieve an average 28-day compressive strength of 3600 psi, or greater, with no individual cylinder compressive strength less than 3000 psi.

F. Density Determination. Produce concrete with an average dry unit weight ranging from 110 to 115 lb/ft³ when tested in accordance with ASTM C567.

CONSTRUCTION DETAILS. Apply the provisions of §557-3 and the following modifications:

A. Concrete Manufacturing and Transporting. Add the following to §557-3.01:

1. Use slump, unit weight and air tests as a control measure to maintain a suitable consistency. Perform slump, unit weight and air tests according to Materials Method 9.2. Determine air content by the volumetric method (roll-a-meter) as described in ASTM C173. Air content and slump placement limits are:

	Minimum	Desired	Maximum
Air Content (%)	5.0	6.5	8.0
Slump (inches)	2 1/2	3-5	5

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SEPARATE WEARING SURFACE - BOTTOM FORMWORK NOT REQUIRED**

2. If the lightweight coarse aggregate moisture content at the time of batching is less than saturated surface dry (SSD), introduce the coarse aggregate, along with approximately $\frac{2}{3}$ of the total mixing water, into the mixer and mix for a minimum of 10 minutes, then continue batching the remaining ingredients. If the coarse aggregate is in an SSD condition, batch the coarse aggregate routinely with the fine aggregate, admixtures, cement, fly ash (or GGBFS), microsilica, and mixing water, then mix completely.

3. Have the lightweight aggregate manufacturer supply a service representative at the site for the first two days of concrete placement operations to assist in the control of lightweight concrete mixing and placement.

B. Handling, Placing and Finishing. Handle and place concrete according to §557-3.05, except that pumping is not permitted. When an integral wearing surface is required, finish the concrete according to 557- 3.07. If the concrete will be overlaid with a separate wearing surface, finish the surface according to 557-3.09.

C. Testing. Test the concrete according to Materials Method 9.2. The unit mass of the fresh concrete during placement should be compared to that which was submitted with trial mix design. Make adjustments to the concrete mix at the batching facility based on slump, unit weight and air tests. The Engineer will cast cylinders, in sets of 2 individual cylinders, at a frequency of 1 set for each 50 yd³, or fraction thereof actually placed. A minimum of 1 set will represent each day's concrete placement.

D. Curing. Cure the concrete according to §557-3.11, except that only continuous wetting is allowed. In cold weather, the provisions of §557-3.12 shall apply.

E. Repairs. Make any repairs as per the provisions of §557-3.16. Proposed repairs require Deputy Chief Engineer, Structures approval.

F. Rejection of Concrete. The Engineer will reject any concrete represented by a 28-day cylinder set with an average compressive strength less than 3600 psi, or an individual cylinder with a compressive strength less than 3000 psi.

G. Loading Limitations. The loading limitations of §557-3.14 apply, except that concrete cylinder sets designated for early loading must attain an average compression strength of 3600 psi, or greater, with no individual cylinder less than 3000 psi.

METHOD OF MEASUREMENT. Apply all of the provisions of §557-4.

BASIS OF PAYMENT. Apply all of the provisions of §557-5.

ITEM 557.6401XX03 - PRECAST CONCRETE DECK - TYPE XX FRICTION
 ITEM 557.6403XX03 - PRECAST CONCRETE APPROACH SLAB - TYPE XX FRICTION
 ITEM 557.11010003 - INTEGRAL PRECAST CONCRETE BARRIER

DESCRIPTION.

Furnish and place precast concrete deck, precast concrete approach slab and integral precast concrete barrier with ultra high performance concrete (UHPC) joints. The maturity method shall be used to estimate the in-place UHPC strength. The time required before removal of the forms and loading of the structure will be determined based on the estimated in-place UHPC strength. "Panels" refers to both the concrete deck and to the approach slab.

XX = Friction Type
01 - Type 1 Friction
02 - Type 2 Friction
03 - Type 3 Friction
09 - Type 9 Friction

MATERIALS

PRECAST CONCRETE PANELS: Materials used in this work shall conform to the NYSDOT Prestressed Concrete Construction Manual (PCCM)-Current Edition and the following:

STEEL EMBEDMENTS. Steel embedments for the panel leveling devices and hold down devices shall be installed in the shop based upon the locations shown on the shop drawings.

Leveling Bolts ASTM F568M, Class 4.6

CONCRETE

28 Day Compressive Strength	5000 psi	(Minimum)
Lifting Strength	3000 psi	(Minimum)
Epoxy Coated Bar Reinforcement	709-04	
Mechanical Connectors	709-10	
Water	§712-01	
Aggregates (Friction Type)	501-202.B	

PRECAST CONCRETE APPROACH SLAB

The supplier must demonstrate a system to place the approach slab using a grout bed such that the approach slab is fully supported at the proper line and grade.

INTEGRAL PRECAST CONCRETE BARRIER: The requirements of the PCCM and the following shall apply.

Tolerances:

- | | |
|---|-------------------|
| 1) Bar Reinforcement Cover | -0, + ½ inch |
| 2) Width of Unit at the top | -0, + ¼ inch |
| 3) Width of Unit at the bottom | -0, + ½ inch |
| 4) Surface deviation from theoretical centerline | ½ inch in 20 feet |
| 5) Vertical Alignment (deviation from a line parallel to theoretical grade) | ½ inch in 20 feet |
| 6) Horizontal and Vertical Alignment (between adjacent units) | 3/16 inch |

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JOINT MATERIAL UHPC: The material shall be Ultra High Performance Concrete, all components supplied by one manufacturer. Materials commonly used in UHPC are:

- Fine aggregate
- Cementitious material
- Super plasticizer
- Accelerator
- Steel Fibers

UHPC material shall meet the following, 28 days unless otherwise noted:

Minimum Compressive Strength (ASTM C39)

High Heat-Treated*	≥ 25 ksi
Medium Heat-Treated 12 hours**	≥ 12 ksi
Not Heat-Treated 14 days***	≥ 21 ksi

Prism Flexural Tensile toughness (ASTM C1018; 12 in. span)	$I_{30} \geq 48$
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Long-Term Shrinkage (ASTM C157; initial reading after set)	≤ 766 microstrain
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Chloride Ion Penetrability (ASTM C1202)	≤ 250 coulombs
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Chloride Ion Penetrability (AASHTO T259; ½ in. depth)	< 0.07 oz/ft ³
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Scaling Resistance (ASTM C672)	$y < 3$
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Abrasion Resistance (ASTM C944 2x weight; ground surface)	< 0.025 oz. lost
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Freeze-Thaw Resistance (ASTM C666A; 600 cycles)	RDM $> 96\%$
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Alkali-Silica Reaction (ASTM C1260; tested for 28 days)	Innocuous
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* High Heat-Treated - According to manufacturer's recommendation, temperature not to exceed 250°F.

** Medium Heat Treated temperatures not to exceed 120°F

*** Not Heat Treated temperature not to exceed 70°F

Results of all the tests above, conducted by an AASHTO accredited testing lab shall be submitted to the DCES along with the installation drawings. Provide to the DCES a list of bridge projects in which the proposed UHPC material has been used as joint fill between precast concrete elements (within or outside the USA). The DCES reserves the right to reject a proposed UHPC material which lacks a proven track record in precast concrete joint filling in bridge applications.

Storage: The contractor shall assure the proper storage of premix, fibers and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.

Acceptance Testing: Note: acceptance testing will be waived if the same material from the same supplier has already been tested according to this standard. The Contractor shall complete the testing of the UHPC a minimum of one month before placement of the joint. The testing sequence will include the submission of a plan for casting and testing procedures to the DCES for review and approval followed by casting and testing according to the approved plan.

Casting and testing must include the following:

A minimum of 12 cylinders 3in. x 6 in. shall be cast.

The temperature during curing shall be as per heat treatment temperature limits established in this specification. 2 cylinders shall be tested each testing interval. Testing intervals are at 10 hours, 12 hours, 14 hours, and 24 hours. The compressive strength shall be measured by ASTM C39. Only a concrete mix design that passes these tests may be used to form the joint.

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Pullout Test: Cast 6 additional cylinders 12 in. diameter and 7.5 in. deep. Each cylinder shall have one 32 in. long epoxy-coated reinforcing bar cast in the center of the circular face. The axis of the bar shall be perpendicular to the formed surface. 3 of the bars shall be #6 bars embedded 5 in. deep and 3 of the bars shall be #4 bars embedded 3 in. deep. These cylinders will be kept wet for four days then delivered to the Materials Bureau for testing according to Test Method No. NY 701-14 E. Contact the Materials Bureau prior to casting for specific instructions on preparing the test specimens. The test will be performed as soon as practical after the corresponding compressive strength samples reach 12 ksi. Acceptance criteria for pullout testing shall be when there is complete tensile failure of the reinforcing bar, prior to pullout from the concrete or failure of the concrete.

EQUIPMENT FOR MATURITY TESTING:

Use a Maturity Meter and thermocouples that can:

- \$ Provide a maturity value based on the Equivalent Age or Temperature Time Method as detailed in ASTM C 1074-11.
- \$ Continuously log and store maturity data.
- \$ Accurate to within +/- 1° F when the meter is calibrated as per the manufacturer's instructions.
- \$ Take readings every half hour for the first 48 hours and every hour after that at a minimum.
- \$ Print data and/or download it into a spreadsheet.

METHODOLOGY FOR MATURITY TESTING:

The procedure for utilizing the maturity method to determine in-place UHPC strengths includes three steps: development of the strength-maturity relationship, monitoring the maturity of the placement, and regular validation of the strength maturity relationship. Any changes in the mix design, its components, or proportions will require that a new strength-maturity relationship be developed.

The strength-maturity relationship shall be developed one month prior to construction. Continue data collection for the strength-maturity relationship after acceptance of the maturity value until the strength reaches 21 ksi.

A procedure to develop the strength-maturity relationship shall be submitted to the DCES for review and approval along with the shop drawings. The submitted procedure shall include all necessary information for the development of the strength maturity relationship. All necessary testing included in the procedure shall be conducted by an AAHSTO accredited testing lab.

CONSTRUCTION

DRAWINGS FOR PRECAST CONCRETE PANELS AND BARRIER

Shop drawings and installation drawings shall be prepared and submitted as per the requirements of the Prestressed Concrete Construction Manual, (PCCM), and the following:

The submitted drawings shall include details of lifting and handling of panels in the production facility and their storage, transportation, handling and storage at the construction site. Lifting holes will not be

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permitted. The proposed handling and lifting shall be such that the maximum tensile stress in concrete due to handling and erection loads shall not exceed $0.15(f'_{ci})^{1/2}$, where f'_{ci} is the concrete compressive strength at the time being considered. Calculations showing actual concrete stresses based upon the proposed support locations and expected dynamic loading of the panels during handling, storage and transportation of the panels shall be prepared by a Professional Engineer and shall be submitted along with the drawings. These drawings and calculations shall be stamped and signed by a Professional Engineer.

Integral precast concrete barrier shall be cast integrally with the precast concrete deck prior to shipping. Proposed procedures for the casting, handling, and shipping shall be included in the drawings for the precast concrete panels.

The proposed method of mixing, placing, and curing the UHPC joints shall be shown on the installation drawings. The Contractor shall perform qualification testing using maturity method and the results shall be shown on the installation drawing to demonstrate that the proposed method of curing will achieve the required strength at the required time.

FABRICATION OF PRECAST CONCRETE PANELS

Fabrication shall meet the requirements of the PCCM and the following:

Fabrication Tolerances

1. Width (transverse direction of the bridge): +1/8, -1/8 in.
2. Length (longitudinal direction of the bridge): +1/8, -1/8 in.
3. Depth (overall): +1/8, -0 in.
4. Bulkhead alignment (deviation from square or designated skew)
 - Vertical 1/4 in.
 - Horizontal 1/4 in.
5. Horizontal alignment (deviation from straight line parallel to centerline of unit):
 - 1/4 in. for 40 ft length
 - 3/8 in. for 40 ft to 60 ft length
 - 1/2 in. for greater than 60 ft length

Welding of steel shall comply with the requirements of the New York State Steel Construction Manual.

Placing Concrete, Curing and Finishing

All requirements stipulated in PCCM shall apply except for the following:

After curing, all form release material and all other forming material adhering to the shear keyway and block out concrete shall be removed. Shear key faces shall be roughened and blast cleaned.

Shipping and Handling of Precast Panels and Precast Concrete Barrier. Shall be as per approved drawings.

Loading of Panels. Equipment weighing more than 2500 pounds shall not be permitted on the precast units between the initial set of the UHPC and the time the UHPC has reached a minimum strength of 10 ksi.

Mixing and Placing UHPC Joints and Haunches. Specifications in the PCCM and the following:

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Thoroughly and continuously wet the concrete contact area for 24 hours prior the placing of UHPC, keep wet and remove all surface water just prior to UHPC placement.

INSTALLATION REQUIREMENTS FOR DECK SLABS

Installation shall meet the requirements of the PCCM and the following:

1. Prior to installing panels, the supporting steel surfaces in contact with the panels or field placed concrete shall be cleaned, including removal of free water, to the satisfaction of the engineer.
2. Installation tolerances shall be as per the approved installation drawings. It is the responsibility of the contractor to develop appropriate controls during the fabrication and installation of the panels so that proper cross slopes and grades are achieved after the diamond grinding operation. Installation drawing shall show the details of the proposed controls.

INSTALLATION REQUIREMENTS FOR APPROACH SLABS

Bed and level slabs in accordance with the system designer's instructions such that the vertical differential across any joint is $\frac{1}{4}$ in. or less. Slabs shall be placed on grade and have grout pumped underneath to ensure that they are completely supported.

INSTALLATION REQUIREMENTS FOR UHPC

The contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of the joints until the Contractor's own staff has become well-trained in the use of the material. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

GROUTING OF HAUNCHES

Grouting shall meet the requirements of the PCCM, except that the requirement related to post-tensioning shall not apply. Details of grouting ports, vents, method of pumping the grout, equipment with necessary back up shall be shown on the installation drawing. Required QC for the grouting also shall be listed on the drawings.

PRE-INSTALLATION MEETING: Convene a preplacement meeting 7 to 14 calendar days before the planned start of slab installation. The contractor shall arrange for an on site meeting with representatives from the UHPC and the precast system suppliers. The contractor's staff and the NYSDOT Engineer and Inspectors shall attend the site meeting. The objective of the meeting will be to clearly outline the procedures for placing and leveling the precast concrete panels and for mixing, transporting, finishing and curing of the UHPC material.

Form Work, Batching and Curing

The design and fabrication of forms shall follow approved installation drawings and shall follow the recommendations of the manufacturer. All the forms for UHPC shall be constructed from plywood or approved equal. The forms shall be coated to prevent absorption of water using a form release agent from the Department's Approved List of Materials.

The contractor shall follow the batching sequence as specified by the supplier and approved by the DCES. The surface of the UHPC field joints shall be filled as shown on the approved drawings.

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The UHPC in the form shall be cured according to Manufacturer's recommendations to attain the required strength shown on the contract documents.

Quality Control

The contractor shall measure the slump flow on each batch of UHPC. The slump flow will be conducted using a mini-slump cone. The flow for each batch shall be between 7 in. and 10 in. The slump flow for each batch shall be recorded in the QA/QC log. A copy of the log shall be given to the Engineer.

Estimation of In-Place Strength:

1. Two thermocouples per each UHPC joints, one at each end, shall be installed. The locations of these installations shall be shown on the installation drawings. These locations shall be revised if directed by the DCES. The thermocouple wiring may be connected to reinforcing steel, but probe endings may not be in direct contact with the steel. Consider structural or exposure conditions when placing thermocouples.
2. Listed actions are allowed when the maturity value of all the thermocouples reaches the corresponding strength values listed below.

Action	Strength Requirement
Removal of top forms	10 ksi
Open Bridge deck to Traffic	12 ksi

3. Record and save the maturity data from the meter until the strength reaches 21 ksi. Disconnect the meter and clip all wires flush with the concrete surface.

A continuous read thermocouple or thermistor with a data logger can be used to estimate in place strength. The methodology outlined in ASTM C 1074-11 will be used. The maturity function used to estimate strength will be calculated with the same formula that is used by the maturity meter that established the initial strength maturity relationship. Copies of the calculations will be provided to the engineer.

Validation of the Strength-Maturity Relationship:

For each day of placement, perform validation tests by casting 7 cylinders. Equip one of the cylinders with a thermocouple. Test the cylinders as close as possible to the maturity value corresponding to 21 ksi. Record the maturity value immediately prior to testing. All testing shall be conducted by an AASHTO accredited testing lab. Report the results to the DCES.

If the average value of compressive strength of each pair of cylinders is within 10% of the estimated value, the strength-maturity relationship will be validated. If the average cylinder value is more than 10% below the estimated value, the strength maturity relationship will need to be re-established. If the first four cylinders produce acceptable results, the remainder need not be tested.

The Department may perform additional testing for research purposes. Casting and testing in addition to that required in this spec will be performed by NYSDOT personnel.

In case of loss of required data, or non verification of the strength-maturity relationship, use the cylinders cast above, one pair at a time, to verify the strength.

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METHOD OF MEASUREMENT. For precast concrete bridge decks and precast concrete approach slabs apply all the provisions of §557-4. For precast concrete bridge barrier apply all the provisions of §569-4.

BASIS OF PAYMENT. For precast concrete bridge decks and precast concrete approach slabs apply all the provisions of §557-5. For precast concrete bridge barrier apply all the provisions of §569-5.

**ITEM 557.2500NN16 - CRACK SEALING USING HIGH MOLECULAR WEIGHT
METHACRYLATE - LINEAR CRACKS**

DESCRIPTION

This work shall consist of furnishing and installing Crack Sealing Using High Molecular Weight Methacrylate in accordance with the contract documents and as directed by the Engineer.

MATERIALS

The high molecular weight methacrylate (HMWM) resin shall be low viscosity and non-fuming. Acceptance is based on the manufacturer certifying that it conforms to the following, and the contractor forwarding the certification to the DCES:

Viscosity	Less than 25 cps when measured according to ASTM D2849
Density	Greater than 8.4 lb/gal. @ 77° F.
Flash Point	Greater than 200° F.
Vapor Pressure	Less than 1.0 mm Hg @ 77° F. (ASTM D 323)
TG (DSC)	Greater than 136° F (ASTM D3418)
Gel Time	Greater than 40 minutes for 3.5 ounces
Percent Solids	Greater than 90 % by weight
Bond Strength	Greater than 1522.3 psi (ASTM C882)

Sand The sand shall be commercial quality dry blast sand. 95% of the sand shall pass the #8 sieve, and 95% shall be retained on the #30 sieve.

The container shall include the following information: The name of the manufacturer, the brand name of the product, the date of manufacture.

CONSTRUCTION DETAILS

Abrasive blast clean the area to be treated, removing all contaminants from the surface. Clean all surfaces and cracks using compressed air which is free of oil and moisture.

Do not apply sealers if rain is expected within 12 hours of completion. Apply sealers to clean, dry surfaces when the surface temperature is at least 50° F, and if near 50° F, rising. The sealer shall be mixed and applied according to the manufacturer's instructions and no more than 5 gallons at a time. Pour sealer into the cracks.

After the resin has been applied, at least 20 minutes shall elapse before applying the sand. The sand shall be broadcast at a rate of approximately two pounds per square yard, completely covering the sealer.

The sealer must be tack-free before traffic is permitted to resume.

METHOD OF MEASUREMENT

This work will be measured as the number of feet of Crack Sealing Using High Molecular Weight Methacrylate satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

**ITEM 557.2600NN16 - CRACK SEALING USING HIGH MOLECULAR WEIGHT
METHACRYLATE - FLOODING**

DESCRIPTION

This work shall consist of furnishing and installing Crack Sealing Using High Molecular Weight Methacrylate in accordance with the contract documents and as directed by the Engineer.

MATERIALS

The high molecular weight methacrylate (HMWM) resin shall be low viscosity and non-fuming. Acceptance is based on the manufacturer certifying that it conforms to the following, and the contractor forwarding the certification to the DCES:

Viscosity	Less than 25 cps when measured according to ASTM D2849
Density	Greater than 8.4 lb/gal. @ 77° F.
Flash Point	Greater than 200° F.
Vapor Pressure	Less than 1.0 mm Hg @ 77° F. (ASTM D 323)
TG (DSC)	Greater than 136° F (ASTM D3418)
Gel Time	Greater than 40 minutes for a 100 gram mass
Percent Solids	Greater than 90 % by weight
Bond Strength	Greater than 1522.3 psi (ASTM C882)

Sand The sand shall be commercial quality dry blast sand. 95% of the sand shall pass the #8 sieve, and 95% shall be retained on the #30 sieve.

The container shall include the following information: The name of the manufacturer, the brand name of the product, the date of manufacture.

CONSTRUCTION DETAILS

Abrasive blast clean the area to be treated, removing all contaminants from the surface. Clean all surfaces and cracks using compressed air which is free of oil and moisture.

Do not apply sealers if rain is expected within 12 hours of completion. Apply sealers to clean, dry surfaces when the surface temperature is at least 50° F, and if near 50° F, rising. The sealer shall be mixed and applied according to the manufacturer's instructions and no more than 5 gal. at a time. Sweep, pour, squeegee, or spray the area to receive the sealers, allowing the sealers to flow into the cracks. If the manufacturer does not recommend an application rate, use 8.5 to 11.8 square yards per gallon, as needed.

After the resin has been applied, at least 20 minutes shall elapse before applying the sand. The sand shall be broadcast at a rate of approximately two pounds per square yard, completely covering the sealer.

The sealer must be tack-free before traffic is permitted to resume.

METHOD OF MEASUREMENT

This work will be measured as the number of square yards of Crack Sealing Using High Molecular Weight Methacrylate satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

ITEM 557.6601NN16 - ULTRA-HIGH PERFORMANCE CONCRETE (UHPC)

DESCRIPTION

This work shall consist of furnishing and installing ULTRA-HIGH PERFORMANCE CONCRETE (UHPC) in accordance with the contract documents and as directed by the Engineer. Strength determination is permitted to be made through compressive testing or maturity testing. Ultra-High Performance Concrete (UHPC) includes, but is not limited to precast deck panel joints, closure pours, link slabs, and joint headers. It does not include bridge deck overlays.

MATERIALS

UHPC shall be accepted based on the Manufacturer and product designation appearing on the Approved List under Bridge Joint Systems. Other materials can be accepted if they meet the requirements below:

UHPC Acceptance Criteria: UHPC which is not on the Approved List can be accepted by meeting the material requirements below. Contact DCES for testing and acceptance procedures. The preparation for the testing and the acquisition of results for the testing may take several months. No extension of time will be granted for completion of testing. All components of Ultra-High Performance Concrete shall be supplied by one Manufacturer. Materials commonly used in UHPC are:

Fine aggregate
Cementitious material
Super plasticizer
Accelerator
Steel Fibers 2% minimum by volume

UHPC Material Properties

UHPC material shall meet the following, at 28 days unless otherwise noted:

Minimum Compressive Strength (ASTM C39)	18 ksi
Minimum Compressive Strength (four days)	12 ksi
Flexural Tension Stress, (ASTM C1609, first crack, minimum)	1.5 ksi
Flexural Tension Stress (ASTM C1609), peak, minimum	2.0 ksi
Flexural Tension ratio, peak to first crack, minimum	1.25*
Long-Term Shrinkage (ASTM C157; initial reading after set)	≤ 766 microstrain
Scaling Resistance (ASTM C672)	y < 3
Abrasion Resistance (ASTM C944 2x weight; ground surface)	< 0.025 oz. lost
Freeze-Thaw Resistance (ASTM C666A; 600 cycles)	RDM > 96%
Alkali-Silica Reaction (ASTM C1260; tested for 28 days)	Innocuous

*If the peak stress exceeds the first crack by at least 100 psi, the first crack stress need not be taken as greater than 1.8 ksi when computing this ratio.

Cast 6 additional cylinders 12 in. diameter and 7 ½ in. deep. Each cylinder shall have one grade 60 epoxy-coated reinforcing bar 32 inches long cast in the center of the circular face. The axis of the bar shall be perpendicular to the formed surface. 3 of the bars shall be #6 bars embedded 5 inches deep and 3 of the bars shall be #4 bars embedded 3 inches deep. These cylinders will be kept wet until delivered to the Materials Bureau for testing according to Test Method No. NY 701-14 E. Contact the Materials Bureau prior to casting for specific instructions on preparing the test specimens. The test will be performed as soon as practical after the corresponding samples reach 12 ksi.

This test is a pullout test. The samples pass if the stress in the bars reaches 60 ksi without the UHPC failing and without the bars pulling out of the UHPC.

ITEM 557.6601NN16 - ULTRA-HIGH PERFORMANCE CONCRETE (UHPC)

High Weight Methyl Methacrylate (HMWM) (used to seal leaks for pours which must be watertight)

The HMWM resin shall be low viscosity and non-fuming.

Acceptance is based on the Manufacturer certifying that it conforms to the following, and the contractor forwarding the certification to the DCES:

Viscosity Less than 25 cps when measured according to ASTM D2849

Density Greater than 8.4 lb/gal. @ 77° F.

Flash Point Greater than 200° F.

Vapor Pressure Less than 1.0 mm Hg @ 77° F. (ASTM D 323)

TG (DSC) Greater than 136° F (ASTM D3418)

Gel Time Greater than 40 minutes for a 100 gram mass

Percent Solids Greater than 90 % by weight

Bond Strength Greater than 1522.3 psi (ASTM C882)

Sand: The sand shall be commercial quality dry blast sand. 95% of the sand shall pass the #8 sieve, and 95% shall be retained on the #30 sieve.

The container shall include the following information: The name of the Manufacturer, the brand name of the product, the date of manufacture.

CONSTRUCTION DETAILS

Installation Drawings: Preparation, submittal to the DCES, approval, and time for review of Installation Drawings shall be per Section 2 of the PCCM. The proposed method of mixing, placing, and curing the UHPC shall be shown on the installation drawings. When using the maturity method, the Contractor shall use the maturity method data shown on the installation drawing to demonstrate that the proposed method of curing will achieve the required strength at the required time. The Contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of the UHPC until the Contractor's own staff has become well-trained in the use of the material. The representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC.

Pre-Pour Meeting

Prior to the initial placement of the UHPC, the contractor shall arrange for an onsite meeting with the UHPC representative. The Contractor's staff and the NYSDOT Engineer and Inspectors shall attend the site meeting. The objective of the meeting is to clearly outline the procedures for mixing, transporting, finishing, and curing of the UHPC material.

Storage

The Contractor shall assure the proper storage of premix, fibers, and additives as required by the supplier's specifications in order to protect materials against loss of physical and mechanical properties.

Form Work, Batching, and Curing

The design and fabrication of forms shall follow approved installation drawings and shall follow the recommendations of the Manufacturer. A top form is required. The forms shall be coated to prevent absorption of water.

New concrete surfaces which will bond with UHPC shall have an exposed aggregate finish unless otherwise prohibited. Existing concrete surfaces shall be roughened to an amplitude of 1/8". Thoroughly and continuously wet the existing concrete contact area for 24 hours prior to placing UHPC, keep the surface wet, and remove all surface water just prior to UHPC placement.

The Contractor shall follow the batching sequence as specified by the supplier. The Contractor shall measure the slump flow on each batch of UHPC. The slump flow shall be conducted using a mini-slump cone. The flow for each batch shall be between 7 and 10 inches.

All UHPC shall be placed within ten feet of its final position.

ITEM 557.6601NN16 - ULTRA-HIGH PERFORMANCE CONCRETE (UHPC)

UHPC shall be filled to a minimum of plus $\frac{1}{4}$ inch above the intended elevation. The UHPC in the form shall be cured according to Manufacturer's recommendations to attain the required strength. The excess UHPC shall then be ground flush to the required elevation.

Estimation of In-Place Strength

- 1) Two thermocouples shall be installed per each UHPC placement, one at each end, at half the depth of the placement, and no nearer to an edge than half the depth. The locations of these installations shall be shown on the installation drawings. These locations shall be revised if directed by the DCES. The thermocouple wiring may be connected to reinforcing steel, but probe endings shall not be in direct contact with the steel. Structural and exposure conditions shall be considered when placing thermocouples.
- 2) Listed actions are allowed when the maturity value of all the thermocouples reaches the corresponding strength values listed below.

Action	Strength Requirement
Removal of forms	10 ksi
Open Bridge deck to Traffic	12 ksi

3. Record and save the maturity data from the meter until the strength reaches 18 ksi. Disconnect the meter and clip all wires flush with the concrete surface.

A continuous read thermocouple or thermistor with a data logger can be used to estimate in place strength. The methodology outlined in ASTM C 1074-11 shall be used. The maturity function used to estimate strength shall be calculated with the same formula that is used by the maturity meter that established the initial strength maturity relationship. Copies of the calculations shall be provided to the DCES for record purposes.

Validation of the Strength-Maturity Relationship

For each day of placement, cast 7 – 3 inch x 6 inch cylinders to be used for validation testing. Equip one of the cylinders with a thermocouple. Test the other cylinders as close as possible to the maturity values corresponding to 8, 10, and 12 ksi. Record the maturity value immediately prior to testing. All testing shall be conducted by an AASHTO accredited testing lab. Report the results to the DCES for record purposes.

If the average value of compressive strength of each pair of cylinders is within 10% of the estimated value, the strength-maturity relationship will be validated. If the average cylinder value is more than 10% below the estimated value, the strength maturity relationship will need to be re-established. If the first four cylinders produce acceptable results, the remainder need not be tested.

The Department may perform additional testing for research purposes. Casting and testing in addition to that required in this spec will be performed by NYSDOT personnel.

In case of loss of required data, or non-verification of the strength-maturity relationship, use the cylinders cast above, one pair at a time, to verify the strength.

Watertight Integrity Test

After a placement has reached the required strength, a watertight integrity test shall be performed in accordance with §567-3.01.H. If leakage occurs the Contractor must seal the entire length of the placement using HMWM at no extra cost to the State.

Sealing

Abrasive blast-clean the area to be treated; removing all contaminants from the surface. Clean adjacent surfaces of the leaking areas using compressed air which is free of oil and moisture.

ITEM 557.6601NN16 - ULTRA-HIGH PERFORMANCE CONCRETE (UHPC)

Do not apply sealer if rain is expected within 12 hours of completion. Apply sealer to clean and dry surfaces when the surface temperature is at least 50° F and, if near 50° F, rising. The sealer shall be mixed and applied according to the Manufacturer's instructions and no more than 5 gallons at a time. Pour the sealer over the leaks.

When the HMWM is placed on a driving surface, sand must be applied to provide friction. After the resin has been applied, at least 20 minutes shall elapse before applying the sand. The sand shall be broadcast at a rate of approximately two pounds per square yard, completely covering the sealer. Once the sealer is cured, any loose sand shall be removed from the surface.

The sealer must be tack-free before construction traffic is permitted to resume.

METHOD OF MEASUREMENT

This work will be measured as the number of cubic feet of ULTRA-HIGH PERFORMANCE CONCRETE (UHPC) satisfactorily furnished and installed.

BASIS OF PAYMENT

The unit price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

<u>Item Number</u>	<u>Description</u>	<u>Pay Unit</u>
557.6601NN16	Ultra-High Performance Concrete	Cubic Feet

NN – serialized by location or by type

ITEM 564.20010008 – HOT-DIP GALVANIZING OF STRUCTURAL STEEL

DESCRIPTION

This work shall consist of hot-dip galvanizing of fabricated structural steel members.

MATERIALS

Materials for galvanizing shall meet the requirements of §719-01, Type I.

CONSTRUCTION DETAILS

Hot-dip galvanizing shall be in accordance with the material specifications.

Galvanizing shall be performed consistent with the current New York State Steel Construction Manual.

METHOD OF MEASUREMENT

This work will be measured as the number of pounds of steel hot-dip galvanized and installed as per the contract documents.

BASIS OF PAYMENT

The unit price bid per pound shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work including transportation to and from the galvanizing facility and any necessary drilling or reaming. No additional payment will be made for additional fabrication steps required as a result of the galvanizing process.

DESCRIPTION

This work shall consist of furnishing all materials and equipment necessary and to apply metalizing in accordance with the contract documents and as directed by the DCES.

Qualification of Metalizing Contractor

The metalizing contractor performing the work shall document previous experience in providing surface preparation for metalizing and metalizing application services in the shop and field, with a minimum history of three (3) successfully completed projects of similar complexity. The contractor shall be certified per the requirements of SSPC-QP 3.

The contractor shall submit experience and qualification records of all personnel performing the work.

Qualification of Thermal Spray Technicians and Personnel

The thermal spray technicians shall be qualified in accordance with ANSI/AWS C2.16 with a minimum passing adhesion of 700 psi, and must hold a certificate of satisfactory completion of training from the equipment manufacturer. The equipment used for qualification shall be equivalent to that used in production.

Each metalizing shift shall have at least one metalizing supervisor, meeting the thermal spray technician requirements, and who will additionally have a minimum of three years documented satisfactory metalizing experience on similar projects.

An SSPC certified Quality Control Supervisor shall be on the thermal spray company's staff and shall provide a Quality Control Plan to the DCES prior to the onset of work. The Quality Control Supervisor shall meet the requirements of Thermal Spray Supervisor as per SSPC-QP 6. Additionally, the Quality Control Supervisor shall have a minimum of five (5) years experience with satisfactory performance in abrasive blast cleaning of steel surfaces according to SSPC-SP 10 and shall have performed similar duties on two successful metalizing projects.

Codes and Standards

The provisions set forth in the latest issue of the following codes and standards shall apply unless otherwise indicated in the contract documents:

ASTM B 833, Standard Specification for Zinc Wire for Thermal Spraying (Metalizing).

ASTM C 633, Test Method for Adhesive/Cohesive Strength of Flame Sprayed Coatings.

ASTM D 4285, Method for Indicating Oil or Water in Compressed Air.

ASTM D 4417, Test Method for Field Measurement of Surface Profile of Blasted Steel.

NACE Standard RP0287, Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape.

ASTM D 4541, Test Method for Pull-Off Strength of Coating Using Portable Adhesion Testers.

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ASTM E1920, Standard Guide for Metallographic Preparation of Thermal Sprayed Coatings.

ASTM E2109, Standard Test Methods for Determining Area Percentage Porosity in Thermal Sprayed Coatings.

ANSI/AWS C2.16, Guide for Thermal-Spray Operator Qualification

ANSI/AWS C2.18, Guide for the Protection of Steel with Thermal Spray Coatings of Aluminum, Zinc, and Their Alloys and Composites.

SSPC-CS 23.00/AWS C2.23M/NACE No. 12, Specification for the Application of Thermal Spray Coatings (Metalizing) of Aluminum, Zinc, and their Alloys and Composites for the Corrosion Protection of Steel.

SSPC Publication, The Inspection of Coatings and Linings: A Handbook of Basic Practice for Inspectors, Owners, and Specifiers.

SSPC-AB 1, Mineral and Slag Abrasives.

SSPC-AB 2, Specification for Cleanliness of Recycled Ferrous Metallic Abrasives.

SSPC-AB 3, Ferrous Metallic Abrasives.

SSPC-PA 1, Shop, Field, and Maintenance Painting of Steel.

SSPC-PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.

SSPC-QP 3, Standard Procedure for Evaluating Qualifications of Shop Painting Applicators

SSPC-QP 6, Standard Procedure for Evaluating the Qualifications of Contractors Who Apply Thermal Spray (Metalizing) for Corrosion Protection of Steel and Concrete Structures

SSPC-SP 1, Solvent Cleaning

SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning.

SSPC-SP 11, Power Tool Cleaning to Bare Metal

SSPC-VIS 1, Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.

Quality Control Plan

Prior to the start of work, the Contractor's QC Supervisor shall provide a written quality control plan and submit it to the DCES for approval. The plan shall include the procedure to be followed and equipment to be used for all processes outlined herein, including surface preparation and metalizing and seal coat application. The plan shall include a method of adhesion testing, thickness measuring, bend test protocol, testing frequency, and MSDS sheets for material utilized on the project. The plan shall outline the quality assurance procedures and any safety precautions that must be followed by workers and inspectors. No work shall commence until the DCES has approved the plan.

Job Reference Standard (JRS)

A job site pass/fail Job Reference Standard, representative of the work to be performed, shall be prepared by the metalizing applicator. The JRS will be used to evaluate the suitability of the application process. The JRS shall be made on a steel plate approximately 18 in. x 18 in. x 0.25 in. and shall be made with the actual equipment and process parameters and procedures (surface preparation, metalizing, sealing, and testing) that shall be used for the contracted work. The JRS shall be made in similar environmental conditions as the work to be performed. Thickness measurements and adhesion tests shall be performed on the JRS per this specification. The JRS

ITEM 572.0002NN01 - METALIZING

will be deemed unsatisfactory if any of the measurements or test results is less than the values indicated herein.

Metallographic testing shall be performed, in accordance with ASTM E1920 and ASTM E2109, on a JRS meeting the requirements of this section. Porosity of the metalized coating shall be less than 10% with less than 5% air inclusions in the film, and shall be fully bonded to the substrate with no air pockets between the coating and substrate. There shall be no interconnected porosity to the substrate for the contract specified thickness, intended technique of application, number of passes, and thickness applied per pass.

For steel assemblies exhibiting acute angles between structural members to be metalized in the shop after assembly, a similarly scaled steel, blasted mockup must be put together emulating the angles encountered. This mockup shall be metalized by the coating applicator, disassembled and adhesion testing shall be performed on the metalizing in the acute angle, per these specifications. If the mockup fails the adhesion test, the applicator shall change the application technique and/or adjust equipment to obtain proper adhesion results, thickness measurements and appearance requirements in acute angles.

Job Control Record (JCR)

The Contractor shall keep a Job Control Record, detailing the essential job information and the in-process quality control checkpoints required by this standard. The JCR shall include information on safety precautions, and the equipment, parameters, and procedures for surface preparation, thermal spraying, and sealing. Failure to perform production work in a manner consistent with the JCR guidelines will be cause for rejection.

MATERIALS

A. METALIZING

Certified alloy wire is required, and shall be composed of 85% zinc and 15% aluminum by weight. Wire shall meet the requirements of ASTM B-833 Standard Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metalizing) for the Corrosion Protection of Steel. The Contractor shall submit a certificate with results of testing for chemical analysis to the DCES, for each lot of wire used on the job. The Contractor shall obtain written certification from the manufacturer of the alloy and will provide the certifications for each lot of wire a minimum of five business days prior to commencement of metalizing.

The metalizing 85/15 alloy shall have a minimum tensile bond of 700 psi.

B. ABRASIVE FOR BLAST CLEANING

Blast media shall be angular steel grit, angular aluminum oxide, or angular crushed slag, evaluated per SSPC-AB 3 for new abrasive material, and shall be capable of producing an angular anchor tooth profile. If abrasive material is to be recycled, the abrasive material shall be

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evaluated prior to each reuse per the requirements of SSPC-AB 2. Use of silica sand, steel shot, or any other abrasives that result in a round surface profile is prohibited.

C. SEALER

Sealer shall UV resistant and be a urethane or epoxy polyamide penetrating sealer, type as recommended by the supplier for use on metalized surfaces. The sealer shall be VOC compliant for use in New York State. Sealer shall be of such viscosity to penetrate pores in metalized coating.

D. SUBMITTALS

The metalizing applicator shall submit the detailed procedures for surface preparation, metalizing application, and application of sealer coat, conforming to these specifications. The procedures shall detail the equipment, application process, in-process quality control, and Job Control Record to be used for the contract work. The information shall include:

1. Detailed procedures for surface preparation, thermal spraying, seal coating, and the in-process quality control checkpoints.
2. Equipment (surface preparation, thermal spraying, seal coating, and the in-process quality control) to be used and for which the detailed procedures apply.
3. Product Data and MSDS sheets for sealer.
4. Blasting media, thermal spray feedstock materials, and seal coat product.
5. Job Reference Standard.
6. Job Reference Standard test results report.
7. Job Control Record.
8. Repair of defective coatings per ANSI/AWS C2.18.
9. Certification of Class B slip coefficient and creep resistance. The certification shall include the written test results, including the thickness range required to meet the certification. Certification of Class B slip and creep resistance is not required for metalized to metalized faying surfaces meeting the requirements of this specification.

This information shall be submitted at least 10 work days prior to the schedule start of the Job Reference Standard (JRS).

CONSTRUCTION DETAILS

A. SURFACE PREPARATION

Prior to blast cleaning, steel surfaces shall be Solvent Cleaned in accordance with SSPC-SP 1, Solvent Cleaning, to remove all visible oil, grease, dirt, salt, and other contaminants. Then, all surfaces to be metalized shall be cleaned to SSPC-SP 10, Near-White Blast Cleaning, standards. All cleaning and coating shall be performed at the same facility. Surface finish and cleanliness shall be confirmed according to SSPC-VIS 1 standards. In the event of a dispute, the written SSPC SP-10 standard will take precedence.

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Unacceptably hard surfaces, as defined by section 602 of the NYSDOT Steel Construction Manual, shall be removed by grinding, machining, or approved heat treating procedures, prior to abrasive blasting.

The substrate shall have an angular anchor tooth profile of 3 to 5 mils. Surface Profile measurements shall be made using X-course profile tape and a micrometer, as outlined in ASTM D4417. "Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel/NACE Standard RP0287, Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape." Spot measurements shall be made approximately every 2000 ft² for automated blasting or 200 ft² for manual blasting. Take three measurements for each spot in an area approximately 1.5 in². Average the measurements and record in the Job Control Record.

Compressed air shall be free of oil and water and shall meet ASTM D4285, method for Indicating Oil or Water in Compressed Air. Utilize a compressed air system capable of delivery at the nozzle of 125 cfm at 120 psi. To minimize any contamination, use an oil/water separator on the airline. 120 psi of compressed air maintains the proper atomization of the molten wire producing the optimum spray pattern.

B. SYSTEM REQUIREMENTS

Only certified spooled metalizing wire, which is properly drawn, spooled and packaged, shall be used.

The metalizing equipment shall be set up, calibrated, and operated according to the manufacturer's instructions and technical manuals or the metalizing applicator's refinement thereto and as validated by the Job Reference Standard.

Spray parameters shall be set for spraying the specified thermal spray material and, at a minimum, be validated with the bend test. A bend test shall be satisfactorily performed at the beginning of crew and shift change.

A copy of the spray parameters used shall be attached to the Job Control Record.

C. SUBSTRATE CONDITION

The steel surface temperature shall be at least 5°F above the dew-point.

For flame spraying, preheat the initial starting area to a minimum of 250°F to prevent condensation of moisture in the flame onto the substrate. Validate preheating and non-preheating requirements with a tensile bond measurement and a bend test.

Time between the completion of the final anchor-tooth blasting (or final brush blasting) and the completion of the thermal spraying shall be no greater than six hours for steel substrates. In high-humidity and damp environments, shorter holding periods shall be used. If rust bloom or a

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degraded coating appears at any time within the six-hour window, the procedure outlined in Section F, Surface or Coating Degradation shall be followed.

Extension of Time of Application

In low-humidity environments or in enclosed spaces using industrial dehumidification equipment, it will be possible to retard the oxidation of the steel and hold the surface finish for more than six hours. The metalizing applicator, with the approval of the DCES, can validate a holding period greater than six hours by determining the acceptable temperature-humidity envelope for the work enclosure by spraying and analyzing bend coupons and tensile-bond coupons.

A 1-mil to 2-mil flash coat of the metalizing may be applied within six hours of completing surface preparation to extend the holding period for up to four further hours beyond the complete application of the flash coat. The final metalizing thickness, however, shall be applied within four hours of the completion of the application of the flash coat provided the metalizing can be maintained free of contamination.

Validate the use of the flash TSC holding period with a tensile-bond measurement and a bend test.

- Clean and abrasive blast a representative job area and three bend-test coupons.
- Apply a flash metalizing to the representative job area and the three bend coupons.
- Wait the delay period in representative environmental conditions and apply the final metalizing thickness.
- Perform adhesion test and bend test on coupons.
- Flash metalizing and holding period are acceptable if the tensile bond and the bend test are satisfactory.

D. METALIZING

The applied 85/15 alloy metalizing thickness shall be a minimum of 12 mils, with a tolerance of - 0 and + 4 mils. For each coated component, the applied thickness shall be measured using a SSPC PA2 type 2 fixed probe gauge properly calibrated per certified coating thickness calibration standards, and measurements shall be recorded in the Job Control Report (JCR). Use a measurement line to measure the peaks and valleys of the metalizing, taking the average value of five readings along a line at 1.0 in. intervals. For complex geometries and geometric transitions, use a measurement spot approximately 1.5 square inches, and do not measure the peaks and valleys of the metalized coating. Record all measurements in the JCR. If upon inspection, and prior to sealer application, the metalizing thickness is less than the above stated requirements, the applicator shall apply additional metalizing to meet the thickness requirements.

No coating shall be applied unless the following conditions are met:

- The receiving surface shall be clean and absolutely dry.
- The surface temperature and ambient air temperature are as recommended by the coating equipment's manufacturer, except in no case shall coating work be performed when surface and ambient air temperatures are less than 40°F.

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- The receiving surface temperature shall be at least 5°F above the dew point.
- The relative humidity shall not exceed 85%.

All coating applied in violation of these conditions shall be completely removed, and the affected surface cleaned and recoated in accordance with the stated requirements at no additional cost to the State.

Any staining that does occur shall be removed in a manner that does not cause damage to the seal or metalized coatings, at no cost to the State.

Surface Roughness: Surface roughness of the metalized coating shall be less than 4 mils in order to avoid unfilled valleys and low areas in the film.

E. SEALER

Sealer shall be applied and cured according to the paint manufacturer's instructions for use with metalizing, or as directed by the Engineer.

The seal coat shall be thin enough to penetrate into the body of the metalizing and seal the interconnected surface porosity. Typically the seal coat is applied at a spreading rate resulting in a theoretical 1.5 mil dry-film thickness.

Sealer shall be applied as soon as possible after thermal spraying, but shall be applied within eight hours after application of metalizing. If a sealer cannot be applied within eight hours, it shall be verified that the metalizing (a) has not been contaminated by visual inspection (10x), and (b) is dust-free (10x) using the clear cellophane tape test per ISO 8502-3 before applying the sealer.

If moisture is present or suspected in the pores of the metalizing, the steel shall be heated to 250 °F to remove the moisture prior to seal coat application. When possible, the steel shall be heated from the reverse side of the metalizing to minimize oxidation and contamination of the metalizing prior to sealing.

During application of the seal coat, it shall be visually validated that there was complete coverage of all intended areas. Companion steel coupons positioned near the metalizing shall receive a seal coat as well. The wet and dry film thicknesses of the seal coat on these companion coupons shall be used to verify that the correct thickness of seal coat is being applied to the metalizing. Measurements shall be recorded in the JCR.

The sealer shall not be applied to faying surfaces prior to assembly. Faying surfaces of all bolted connections shall be masked prior to application of the seal coat. Touch-up field sealant shall be applied after assembly of the connection.

F. SURFACE OR COATING DEGRADATION

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If rust bloom, blistering or a degraded coating appears at any time during the application of the metalizing, the following procedure applies:

1. Stop spraying.
2. Mark off the satisfactorily sprayed area.
3. Call the Thermal Spray Inspector/Foreman to observe and evaluate the error.
4. Report the deficiency to the purchaser and record the deficiency.
5. Repair the unsatisfactory area by removing the degraded metalizing, re-blast to a minimum near-white metal finish (SSPC-SP 10 standard), and returning to the specified anchor tooth profile depth.
6. Recoat the blasted area as per this specification.
7. Record the actions taken to resume the job in the JCR.

G. FIELD REPAIRS

The only field work allowed to be done under this item is touch-up work after all steel erection and all concrete placement has been completed. All areas requiring field repairs shall be clearly marked. All the requirements of this specification shall apply to field coating material with the following modifications:

1. All dirt, grease and other foreign matter shall be removed in accordance with SSPC-SP 1, Solvent Cleaning. Clean the damaged area of all loose and cracked coating by power tool to bare metal in accordance with SSPC-SP 11, Power Tool Cleaning to Bare Metal.
2. Roughen the damaged area and the surrounding 2 inches to produce a suitable anchor for the coating. All repaired areas shall be tested for proper anchor tooth profile in accordance with ASTM D4417 and as per this specification.
3. All damage to the coating system shall be corrected by the contractor in accordance with the requirements of this specification and to the satisfaction of the Engineer at no additional cost to the State.
4. The overlap of thermal spray edges shall be tested for proper adhesion at each repair location in accordance with this specification.

H. ADHESION TEST

Random adhesion testing shall be performed for each coated component, utilizing self aligning portable pull-off adhesion testing equipment, in accordance with ASTM D 4541 standards. The minimum tensile bond value shall be 700 psi.

Use adhesive recommended by the instrument manufacturer, or equivalent. Attach adhesive manufacturer's instructions to the job control record.

One portable tensile-bond measurement shall be made every 500 ft². If the tensile bond is less than the contract specification, additional tensile bond measurements shall be made to identify the limits or boundaries of the degraded metalizing. The degree of added testing that is necessitated by coating deficiencies will be solely determined by the State, and shall be performed at no added cost to the State. Any degraded metalizing shall be removed and reapplied as per Section F, Surface or Coating Degradation. The tensile force shall be measured

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to 700 psi. The tensile force shall then be reduced and the tensile fixture removed without damaging the metalizing.

I. BEND TEST

Conduct a bend test at the beginning of each work shift or crew change:

1. Use carbon steel coupons of approximate dimensions 2 in. x 4 in. to 8 in. x 0.050 in.
2. Surface preparation according to contract specification.
3. Spray 12-mil to 15-mil thick metalizing in crossing passes, laying down approximately 3 to 4 mils for each pass.
4. Bend coupons 180° around a 0.5-in. diameter mandrel.
 - a. Bend test passes if there is no cracking or only minor cracks with no spalling or lifting (by a knife blade) from the substrate.
 - b. Bend test fails if the coating cracks with lifting (by a knife blade) from the substrate.

Bend test shall be performed on coupons without sealant coats.

J. WEATHER CONSIDERATIONS:

Thermal spraying in low-temperature environments (below freezing):

Substrate shall meet the surface temperature and holding period specified in Section C, Substrate Condition. No moisture or condensation is permissible on the surface during surface preparation and thermal spraying.

Qualify metalizing period with a tensile-bond measurement and a bend test. Meet the tensile bond and metallographic requirements specified herein.

METHOD OF MEASUREMENT

This work will be measured on a lump sum basis.

BASIS OF PAYMENT

The lump sum price bid shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

Note: “nn” denotes a serialized pay item.

572.00020101	Metalizing, Type 1
572.00020201	Metalizing, Type 2
572.00020301	Metalizing, Type 3
572.00020401	Metalizing, Type 4
572.00020501	Metalizing, Type 5
572.00020601	Metalizing, Type 6

**ITEM 603.0791XX06 - EXTENSION OF EXISTING CULVERTS WITH
CORRUGATED STEEL PIPE - PAVED INVERT**

DESCRIPTION

Under this item the contractor shall extend existing culverts in accordance with the contract plans and as directed by the Engineer.

MATERIALS

Materials shall meet the requirements of the following specifications:

203-2.02	Select Granular Fill
707-02	Round Corrugated Steel pipe & Pipe-Arches

CONSTRUCTION DETAILS

The requirements specified under Section 603-3 of the Standard Specifications shall apply except for modifications on the plans or as directed by the Engineer.

METHOD OF MEASUREMENT

This work will be measured as the number of linear feet along the bottom centerline of the corrugated steel pipe extension furnished and incorporated in the work or as directed by the Engineer in writing.

BASIS OF PAYMENT

The accepted quantities of all pipe extensions shall be paid for at the contract price bid which shall include the cost of furnishing all labor, materials, and equipment necessary to complete the work including pipe, trench and culvert excavation, and backfill conforming to the applicable standard sheets, plan or as directed by the Engineer.

Concrete collars, galvanized end sections and sheeting shall be paid for under their respective items.

**ITEM 603.0791XX06 - EXTENSION OF EXISTING CULVERTS WITH
CORRUGATED STEEL PIPE - PAVED INVERT**

Payment will be made under:

<u>Item No</u>	<u>Item</u>	<u>Units</u>
603.07911806	Extension of Existing 18" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07912406	Extension of Existing 24" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07913006	Extension of Existing 30" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07913606	Extension of Existing 36" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07914206	Extension of Existing 42" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07914306	Extension of Existing 42" x 29" Arch Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07914806	Extension of Existing 48" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07914906	Extension of Existing 49" x 33" Arch Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07915706	Extension of Existing 57" x 38" Arch Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07916406	Extension of Existing 64" x 43" Arch Culverts with Corrugated Steel Pipe - Paved Invert, 12 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot
603.07917206	Extension of Existing 72" Dia Culverts with Corrugated Steel Pipe - Paved Invert, 10 Ga, (2 5/8" x 1/2" Corrugations)	Linear Foot

ITEM 607.99620010 - NOISE BARRIER SYSTEM (HIGHWAYS)

DESCRIPTION

This work shall consist of designing, furnishing and erecting noise barriers as detailed and at the locations shown on the Plans or as directed by the Engineer.

All noise barriers shall consist of posts, panels, foundations, and all other associated members and attachments necessary to fabricate and erect sound abatement structures.

Post spacing for panel systems shall be as specified on the plans.

MATERIALS

The noise barrier shall meet the material requirements of §704-03 Precast Concrete - General or §718-01 Prestressed Concrete Units (Structural) with the following modifications and additions:

A. Concrete for Noise Barrier Posts, Panels and Footings

1. Concrete for precast noise barrier panels and columns shall have a minimum compressive strength of 5 ksi at 28 days after casting. Concrete for panels and columns shall have an integral color pigment.
2. Concrete for cast in place footings shall be Class HP concrete conforming to the requirements of Section 501.
3. When a prestressed concrete barrier system is chosen, all precast units shall meet the requirements of the New York State Prestressed Concrete Construction Manual (P.C.C.M.). Also, the Contractor shall notify the Deputy Chief Engineer Structures (D.C.E.S.) of the source of prestressed units for approval within (7) days after the award of the contract.

B. Structural Steel

Steel shall meet the requirements of Subsections 709-04 and 715-01 or 563-2.02 and 709-06.

1. When base plates are used, they shall be fabricated from ASTM A572 steel and galvanized per §719-01, Type II.
2. When anchor bolts are used, they shall be hot-dipped galvanized ASTM A449 conforming to §723-60. Nuts shall be galvanized steel heavy hex nuts meeting the requirements of ASTM A194, Grade 2H.
3. Nuts attached to threaded rebars shall be carbon steel heavy hex nuts meeting the requirements of ASTM A194, Grade 2H. These nuts and all exposed rebars shall be coated, after assembly, with a galvanized repair material appearing on the Department's Approved List.

ITEM 607.99620010 - NOISE BARRIER SYSTEM (HIGHWAYS)

4. When threaded reinforcing is used as part of the design, the threads shall meet the requirements of ANSI B1.1
5. All exposed steel to be shop painted with three coats to match in color concrete panels in accordance with the Special Note on Preparation and Painting of Steel Surfaces.

C. Integral Color and Anti-Graffiti Coating

1. Integral Color

The precast concrete shall be integrally colored using a pigment coloring system meeting the requirements of ASTM C979. Pigment for integrally coloring concrete shall be a chemically pure material pigment, manufactured by a company with proven color mixes capable of producing approved custom colors complying with all environmental codes and ordinances and as approved by the Engineer. The admixture color shall produce a color conforming to the Federal Standard 595B. The color shall be as indicated on the Plans.

2. Anti-Graffiti Coating

Exposed concrete surfaces shall receive an anti-graffiti coating where indicated on the Plans. The anti-graffiti coating shall be a two-component, oil free, non-yellowing, aliphatic, polyester polyurethane coating. The material shall be approved by the Engineer prior to its application.

D. Form Liners

Form liners shall be of elastomeric type of the patterns indicated on the Plans. The liner may be factory bonded or field laminated following the manufacturer's recommendations and instructions. The number of uses per form liner shall not exceed the manufacturer's recommendations.

E. Paint

Paint shall conform to the Special Note "Preparation and Painting of Steel Surfaces" in the Proposal.

All other materials specified in the Contractor's noise barrier design shall be in accordance to the appropriate section of the NYSDOT Standard Specification (US Customary Units) of May 1, 2008.

FABRICATION (Concrete Panels and Posts)

The noise barrier shall meet the fabrication, curing and repair requirements of §704-03 Precast Concrete - General and/or §718-01 Prestressed Concrete Units (Structural) with the following modifications and additions:

ITEM 607.99620010 - NOISE BARRIER SYSTEM (HIGHWAYS)

A. General

Panels and posts shall be fabricated to conform to the shapes, sizes, textures, and colors shown on the Plans.

The contractor shall provide complete design details of the noise barrier. Noise barrier designs shall be submitted by the contractor, to the Department, for approval. Six (6) complete sets of working drawings and two (2) sets of design calculations for the concrete panels, posts, and foundations shall be submitted to the Materials Bureau or the Structures Division for approval as follows: The processing, approval, and transmittal of noise barrier designs shall be in accordance with procedural directives of the Materials Bureau for Precast Concrete Systems and the Structures Group for the Prestressed Concrete Systems and any other procedural directives as applicable. Designs shall be submitted to the Engineer at least 45 working days prior to the start of fabrication and shall include a complete set of working drawings and a complete set of design calculations. Design of the noise barrier system shall be in accordance with the AASHTO "Guide Specifications for the Structural Design of Sound Barriers, 1989" & "2002 Interim to Guide Specifications for Structural Design of Sound Barriers" except that the design wind load shall be 39 lb/sq ft applied perpendicular to the wall surface. For noise barriers in excess of 29 feet in height the contractor shall use design wind loads as specified by the Deputy Chief Engineer Structures (D.C.E.S.). The drawings and design calculations shall be stamped by a Professional Engineer licensed, and registered, to practice in New York State.

The manufacturer shall produce panels and posts that are uniform in appearance. The units shall be cast from steel forms with an elastomeric form liner of specified textures.

The panels and posts shall have a surface texture or treatment on both the highway and residential sides as shown on the Plans. The panel fabricator shall stipulate on the shop drawings the method he intends to use to achieve the above stated surface treatments. A sample of 24 inch by 24 inch by full panel thickness of the noise barrier panel with the integral color and with all proposed surface treatments shall be submitted to the Engineer for color approval prior to production of the sample noise barrier panels. The concrete precaster shall then construct, at his plant or at a location on the project determined by the Engineer, an acceptable sample noise barrier wall consisting of five posts and four panels. The wall shall be a minimum of 18 ft high and shall be the same size and configuration as the noise barriers on the actual project. These test posts and panels will be used to determine the acceptability of the various surface treatments, color and quality of the construction of both the roadway and residential sides of the noise barrier. If test sections are found to be unacceptable, the concrete precaster shall make additional samples until an acceptable product is produced. Any additional posts and panels will be made at the Contractor's expense. No panels for the actual noise barrier shall be fabricated until written approval of the sample noise barrier is given. Once these posts and panels have been approved, they shall be retained and used as the standards to determine acceptability of production posts and panels. The panels may be used on the Project at the end of precasting operations when released by the Engineer.

ITEM 607.99620010 - NOISE BARRIER SYSTEM (HIGHWAYS)

B. Integrally Colored Concrete.

The exact quantity of pigment to be added shall be determined based on the preparation, examination and approval of the 24 inch by 24 inch by full panel thickness test panel or panels to produce the color in the materials §C.1 of this Specification.

The tint used for all the concrete in the posts and panels shall be from the same batch.

A high quality form release oil, compatible with the integral color, shall be used.

C. Quality Assurance

1. When a Precast Noise Barrier System is used the Sampling and Testing, Shipping and Basis of Acceptance for the precast noise barrier units shall be in accordance with the requirements of §704-03.
2. When a Prestressed Noise Barrier System is used the inspection, testing, and acceptance for shipping shall be in accordance with the P.C.C.M.
3. The units arriving at the job site are subject to final evaluation by the Engineer. Damaged or defective units are subject to rejection.

CERTIFICATION

The Contractor shall submit a certificate stating his compliance with these Specifications and the Plans.

CONSTRUCTION DETAILS

Holes for post foundations shall be preaugered, true, and plumb as approved by the Engineer. Precautions shall be taken to protect the holes from collapse. Holes shall contain no free water at the time of concrete placement. The holes shall then be filled with Class HP concrete in direct contact with the soil, properly consolidated to a point shown on the Plans as the top of footing elevation. Posts and panels shall be true and plumb and installed after a seven day curing period in accordance with the approved Contractor's noise barrier design details. The Contractor shall perform any required grading as specified on the plans.

The Contractor shall employ an approved jig method to set posts or post plate anchor bolts to assure proper centerline to centerline spacing and plumbness of posts. The Contractor shall submit shop drawings for the jig method to be employed to the Engineer prior to the use.

After the posts are set in their final, truly vertical position, if base plates are used, the space between the baseplate and the top of the footing shall be filled with grout meeting the requirements of Section 701-05, Concrete Grouting Material. The requirements of §568-3.02 shall apply.

After final placement, exposed panel faces shall have the anti-graffiti coating applied where indicated on the Plans in accordance with the manufacturer's surface preparation instructions and

ITEM 607.99620010 - NOISE BARRIER SYSTEM (HIGHWAYS)

recommendations.

Minor defect repairs such as touch-up field painting shall be made as ordered by the Engineer after final placement.

METHOD OF MEASUREMENT

The Noise Barrier System will be measured by the total number of square feet of the noise barrier measured from the top to the bottom of the wall panels and from center to center of posts. Only one side of the barrier will be measured for payment.

BASIS OF PAYMENT

The unit price bid per square foot of Noise Barrier System shall include the cost of all structural design and detailing, as well as all labor, materials, grading, form liners, anti-graffiti coating and equipment necessary to perform the work. Structural steel, grout, footing concrete, and all other materials required by the Contractor's specific noise barrier design will not be paid for under any other item. No additional payment will be made for the required samples.

Progress payments for this work will be made as follows:

1. Twenty (20) percent of the quantity will be paid for after all foundations are in place to the satisfaction of the Engineer.
2. Twenty (20) percent of the quantity will be paid for after all posts have been erected to the satisfaction of the Engineer.
3. The remainder of the quantity will be paid for after all panels have been erected to the satisfaction of the Engineer.

ITEM 611.19010024 - POST-PLANTING CARE WITH REPLACEMENT - MAJOR DECIDUOUS TREES

ITEM 611.19020024 - POST-PLANTING CARE WITH REPLACEMENT - MINOR DECIDUOUS TREES

ITEM 611.19030024 - POST-PLANTING CARE WITH REPLACEMENT - CONIFEROUS TREES

ITEM 611.19040024 - POST-PLANTING CARE WITH REPLACEMENT - DECIDUOUS SHRUBS

ITEM 611.19050024 - POST-PLANTING CARE WITH REPLACEMENT - EVERGREEN SHRUBS

ITEM 611.19060024 - POST-PLANTING CARE WITH REPLACEMENT- VINES, GROUNDCOVERS

ITEM 611.19070024 - POST-PLANTING CARE WITH REPLACEMENT - HERBACEOUS PLANTS

DESCRIPTION

This work consists of the care of newly planted and transplanted trees, shrubs, vines, groundcovers and other plants and replacement of plants in kind and as necessary, in accordance with the contract documents and as directed by the Engineer.

MATERIALS

Materials shall meet the requirements of the following subsections of Section 700 *Materials and Manufacturing*.

Water	712-01
Topsoil	713-01
Mulch for Landscape Bedding	713-05
Trees, Shrubs and Vines	713-06
Materials for the Protection of Plants	713-08
Pesticides	
713-13	

CONSTRUCTION

Post-Planting Care. The Contractor shall perform all work as specified under Standard Specification section **611-3.05 Post-Planting Care**.

Replacement Planting. Plants that die, become diseased or badly impaired during Post-Planting Care shall be removed and replaced in kind once with new, healthy plant material, in the same location as the initial planting. Replacement planting shall occur within the planting seasons shown in Standard Specification **Table 611-1**. For any plants replaced during the Post-Planting Care period, Post-Planting Care shall continue to the end of the period.

Replacement plants shall be planted, maintained and accepted per Standard Specification **Section 611-3.01**. Planting soil used in the initial planting shall be reused for replacement plants and shall be supplemented with topsoil at no additional cost if additional material is needed to meet grade and surface finish. Watering shall accompany backfilling, at no additional cost. No replacement tree shall be staked, guyed or anchored.

ITEM 611.19010024 - POST-PLANTING CARE WITH REPLACEMENT - MAJOR DECIDUOUS TREES

ITEM 611.19020024 - POST-PLANTING CARE WITH REPLACEMENT - MINOR DECIDUOUS TREES

ITEM 611.19030024 - POST-PLANTING CARE WITH REPLACEMENT - CONIFEROUS TREES

ITEM 611.19040024 - POST-PLANTING CARE WITH REPLACEMENT - DECIDUOUS SHRUBS

ITEM 611.19050024 - POST-PLANTING CARE WITH REPLACEMENT - EVERGREEN SHRUBS

ITEM 611.19060024 - POST-PLANTING CARE WITH REPLACEMENT- VINES, GROUNDCOVERS

ITEM 611.19070024 - POST-PLANTING CARE WITH REPLACEMENT - HERBACEOUS PLANTS

METHOD OF MEASUREMENT.

The quantity to be measured for payment will be the number of plants of each type cared for and, if necessary, replaced in kind.

BASIS OF PAYMENT.

The unit price bid shall include the cost of all labor, materials, and equipment necessary to satisfactorily complete the work.

Payment will be made under:

Item No.	Item	Pay Unit
611.19010024	Post Planting Care with Replacement - Major Deciduous Trees	Each
611.19020024	Post Planting Care with Replacement - Minor Deciduous Trees	Each
611.19030024	Post Planting Care with Replacement - Coniferous Trees	Each
611.19040024	Post Planting Care with Replacement - Deciduous Shrubs	Each
611.19050024	Post Planting Care with Replacement - Evergreen Shrubs	Each
611.19060024	Post Planting Care with Replacement- Vines, Groundcovers	Each
611.19070024	Post Planting Care with Replacement - Herbaceous Plants	Each

ITEM 634.99010017 - BUILDING CONDITION SURVEY

ITEM 634.99020017 - VIBRATION MONITORING (NONBLASTING)

DESCRIPTION

A. Building Condition Survey. This work shall consist of performing a building condition survey(s) and preparing permanent records as indicated in the contract documents prior to the commencement of work, after completion of work, and at locations and times during construction as directed by the Engineer.

B. Vibration Monitoring (Nonblasting). This work shall consist of performing vibration monitoring of background and construction activities and preparing daily and summary report(s) of vibration readings.

MATERIALS

A. Building Condition Survey. Provide general photography and video equipment, analog or digital, capable of superimposing the date and time on all images.

B. Vibration Monitoring (Nonblasting). Provide a 3-component seismograph, capable of measuring particle velocity data in three mutually perpendicular directions. Annual factory calibration is required throughout the duration of the work.

CONSTRUCTION DETAILS

A. General. The Contractor shall engage the services of a firm capable of furnishing a New York State licensed Professional Engineer to conduct a condition survey of the existing building(s) indicated in the contract documents in the Special Note entitled Vibration Criteria and an experienced vibration monitoring Consultant to measure peak particle velocities prior to, and during, construction operations. Submit as proof to the Deputy Chief Engineer Technical Services (DCETS) the experience and qualifications of the firm's personnel conducting the work.

B. Building Condition Survey. Provide, as a minimum, the following information:

1. Photographic and videotape documentation of the interior and exterior condition of the building(s).
2. Extent and location of existing signs of building distress such as cracks, spalling, signs of settlement, flooding, leaking, etc.

The Engineer may accompany the Contractor on each building condition survey for verification of the data recorded. Provide two copies of all documentation of each building condition survey to the Engineer.

C. Vibration Monitoring (Nonblasting). The DCETS may waive the requirements of vibration monitoring based on the results of the building condition survey.

Perform continuous vibration monitoring during construction operations when adjacent construction activities make monitoring prudent. The Contractor shall perform contract work in

ITEM 634.99010017 - BUILDING CONDITION SURVEY

ITEM 634.99020017 - VIBRATION MONITORING (NONBLASTING)

a manner that will limit construction vibration at the specified locations to within the limits set within the contract documents.

1. Submittal of Written Vibration Monitoring Plan. Prior to performing work adjacent to specified locations, a written Vibration Monitoring Plan prepared by the Contractor shall be submitted to the Engineer a minimum of 10 work days in advance for approval. The Engineer will send a copy of the Vibration Monitoring Plan to the Geotechnical Engineering Bureau, Engineering Geology Section, for review and written comment. The vibration monitoring plan may be returned to the Contractor for revision or clarification.

The vibration monitoring plan shall include the necessary information to outline the recording collection. The vibration monitoring plan shall include, but not be limited to, the following items:

a. Contract Designations

- The name of vibration monitoring specialist(s).
- The scheduled start date and length of construction operations which require vibration monitoring.
- The limits of vibration monitoring work, including sites on or off State-owned right-of-way.
- The location of all structures to be monitored in proximity to the construction operation.
- The location of any underground utilities in proximity to the construction operation.

b. Experience and Equipment

- Submit proof and details, as references, of two projects in the past five years where the vibration monitoring consultant performing the work has satisfactorily monitored construction operations by recording maximum peak particle velocities (PPVs). Include contact information for each reference.
- Submit information on the required 3-component seismograph, capable of measuring particle velocity data in three mutually perpendicular directions, including: the manufacturer's name, model number, and documentation of factory calibration performed within the last 12 months.

c. Methods and Procedures

- The location of adjacent structures to be monitored and maximum allowable PPVs as indicated in the contract documents. If not otherwise specified, a maximum allowable PPV in accordance with the United States Bureau of Mines (USBM) Vibration Criteria (Figure 1) shall be observed at all structures.
- The location of seismograph(s) placements, as directed by the Contractor's Professional Engineer. Recording seismographs may be installed on selected structures.
- Appropriate details for anchoring the geophone(s).

- The procedure for tracking PPV throughout construction operations (e.g., Pile Driving Operations: pile tip vs. vibrations may be correlated through time of day. A record of the time of day at each depth interval, included on the pile driving records, would be required to correlate to a time-based readout of PPV).

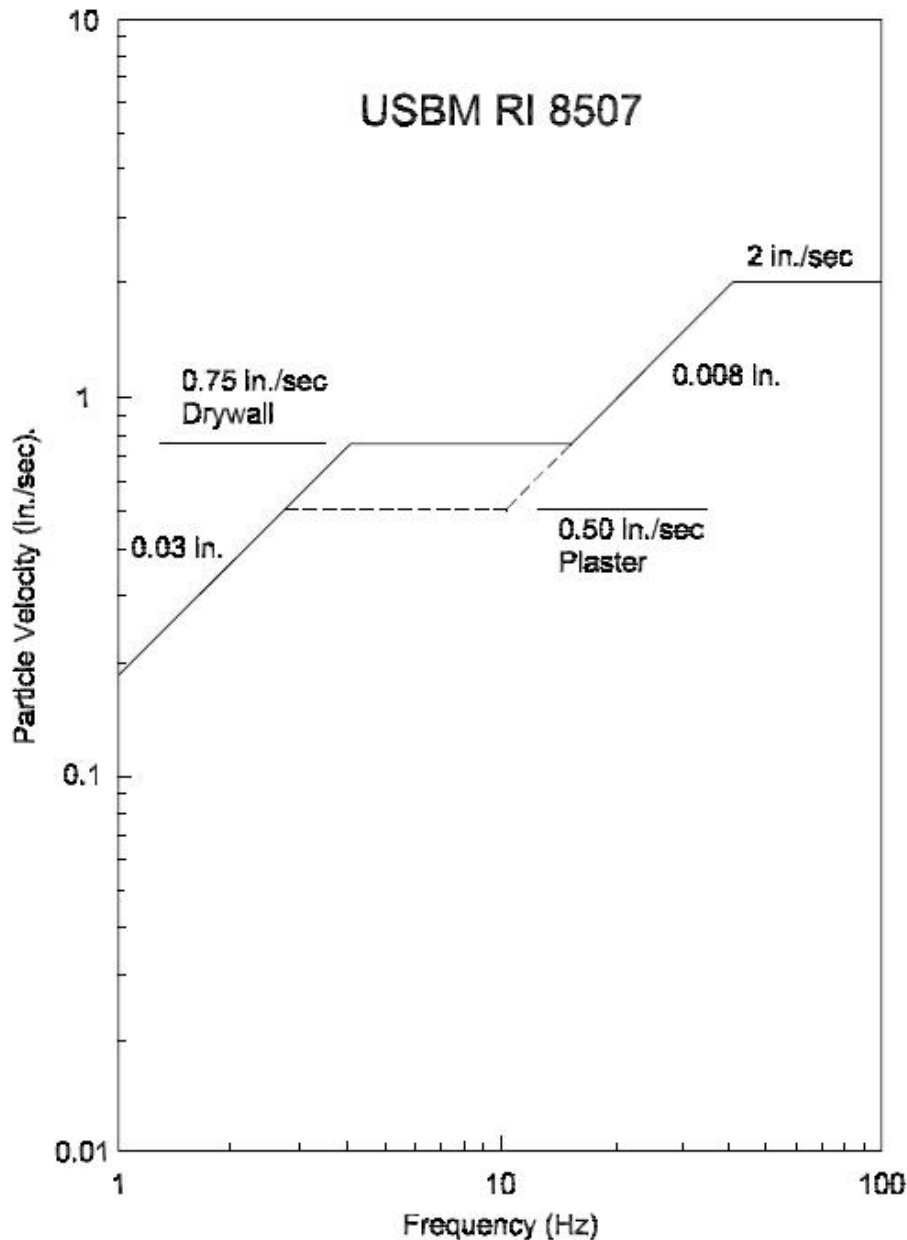


Figure 1—Safe Vibration Limit Recommendations for Residential Structures

Figure 1 – USBM Vibration Criteria (after Siskind et al, 1980)

The figure provides a “threshold damage” limit, defined as cosmetic damage (e.g., cracking) within the structure, categorized by both frequency ranges and particle velocity

ITEM 634.99010017 - BUILDING CONDITION SURVEY

ITEM 634.99020017 - VIBRATION MONITORING (NONBLASTING)

2. Measuring Vibrations. The Contractor shall inform the Engineer immediately each time measured particle velocities exceed 85% of the allowable peak particle velocity. The Contractor shall make equipment or procedural modifications as required to avoid exceeding the allowable vibration intensity.

If the measured velocities exceed the maximum allowable PPVs, the Contractor shall stop operations immediately and revise equipment and procedures to reduce vibrations to allowable levels.

The Contractor shall be in communication with his monitoring firm's personnel during vibration monitoring at all locations to verify the data recorded.

The Contractor shall provide the Engineer with the results of daily vibration monitoring, one work day after the readings are taken. Upon completion of the construction operations for those locations requiring vibration monitoring, the daily submittals shall be synthesized into a final report.

If the seismographs show any indication of damage or vandalism, the seismographs shall be immediately recalibrated or replaced.

METHOD OF MEASUREMENT

A. Building Condition Survey. This work will be measured on a lump sum basis.

B. Vibration Monitoring (Nonblasting). This work will be measured on a lump sum basis.

BASIS OF PAYMENT

The unit price bid for building condition survey(s) and vibration monitoring shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work.

Vibration Monitoring (Nonblasting). Progress payments will be made for this item paid proportionally in accordance with the amount of work completed, measured on a workday basis.

Payment will be made under:

Item No.	Item	Pay Unit
634.99010017	Building Condition Survey	Lump Sum
634.99020017	Vibration Monitoring (Nonblasting)	Lump Sum

ITEM 637.4000nn20 - WEBCAM SYSTEM

DESCRIPTION

This work shall consist of providing, installing, maintaining and removing a webcam system, with a camera mounted on wood utility pole. A single website for image storage and online access may be used for multiple cameras, provided the images are organized and available for each camera separately.

MATERIALS

The webcam system shall meet the following material requirements:

Camera

- The high definition camera and lens assembly shall take high resolution (minimum 16 megapixel - 4928 x 3264) digital still color images and have digital pan, tilt, and zoom capabilities
- Imager: 23.6 X 15.6 CMOS.
- Auto Features: Focus, Shutter, ISO, and white balance.
- Powered by 120 VAC electrical supply, GFCI protected (provided, installed, maintained and removed by Contractor).

Camera Enclosure

- The camera enclosure shall be UL compliant and shall meet NEMA Type 3R standards.
- Include provisions for a fixed installation to a pole or wall.
- Shall include a thermal insulation package, heater, blower, window defroster kit, sun shroud and shall operate within a minimum temperature range of -10°F to 110°F.
- Powered by 120 VAC electrical supply, GFCI protected (provided, installed, maintained and removed by Contractor).

Interface and Online Access

- The system must provide wireless cellular modem as an option for uploading the digital still images.
- The online interface system shall allow viewing of all high-definition digital still images captured and stored during the duration of the contract over the internet with password-protection.
- The still images shall be in a non-proprietary format that can be freely viewed with most image viewing software (.bmp, .jpeg, .tif or .gif)
- Navigation: Calendar based navigation system for selecting specific images on specific days.
- Capable of viewing actual live video.
- HD Snapshot on Demand: HDR (High Dynamic Range) Imaging and Additional Special Effects Including Architectural Miniature, Artistic Color Sketch and Cinematic Black & White
- Graphical mark-up tools for detailing and creating overlays on images.
- Graphical weather applet displaying ten points of local weather data and 48-hour forecast.
- Remote cellular monitoring screen displaying connectivity, network traffic and modem temperature.
- Remote wireless radio monitoring screen displaying connectivity, network traffic and Google Map features including wireless radio locations.
- Image Comparison: Capability to choose and overlay images from two different dates in the same viewing window
- Zoom: Pan and zoom capability for zooming into the high definition images.
- Remote Solar Monitoring Screen Displaying the DC Amperage Output of Solar Panels.
- Fullscreen: Screen maximizing the view of the images on the users monitor.
- Slideshow: Capability to browse through images, moving forward and backward in time by individual image and by day.
- Picture in Picture to view live video, while viewing high definition images.

ITEM 637.4000nn20 - WEBCAM SYSTEM

- All Images are the Copyright of the Department and Protected on Secure Servers Owned and Operated by the System Vendor.

Embedded Wood Utility Pole

- The pole shall be a minimum 60 feet in length, Southern pine and meet the requirements of ANSI #05.01 for Class 4 utility type poles.
- The pole shall be given a water borne preservative treatment in accordance with §708-31.

CONSTRUCTION DETAILS

The Contractor shall provide, install and maintain a fully functional webcam system including an electrical power supply, camera hardware, mounting pole and equipment, data connections, image storage, online interface for the system and technical support. The Contractor is required to have the webcam system's vendor made available for support services and equipment maintenance/repairs.

The Contractor shall provide, install, maintain and remove the webcam system. The Contractor shall coordinate with the Engineer to install the camera in an approved location and provide password access to the webcam system's Internet site. The camera shall be installed so that the position of the sun or any man-made light source does not point directly into the camera. The camera shall be tested at the site both prior to and subsequent to installation, including having the webcam system's vendor remotely confirm both successful tests. The Contractor shall clean the installed components in accordance with manufacturer's recommendations at least monthly, or as needed to ensure image clarity.

The pole shall be installed plumb, in a hole of sufficient depth to allow for a minimum of 10 feet embedment. The area around the pole shall be backfilled with suitable material and thoroughly compacted. The Contractor shall restore, in kind, all areas which were disturbed by the pole installation operation.

The webcam system shall consist of all-weather, tamper/impact resistant, fixed mounted camera enclosure with integrated, fixed high definition camera. The camera shall have the ability to take a high-resolution digital still color image of the construction site at a set time interval, at least every fifteen (15) minutes, and securely upload the still images to a secure, password-protected website. The image data shall at all times be the property of the State. The digital still images shall be stored on a remote server (with sufficient storage capacity to store all images taken on the contract) and be made available for viewing on the website in chronological order. The website shall provide the ability to zoom in on the images. Password access to the website shall be granted to those parties specified by the Engineer (Department staff and the Contractor, at a minimum). The Contractor shall provide the Department with an archive in DVD or external hard drive format of all the digital still images in a sortable/identifiable format. The still image file names shall include the date and time taken.

The Contractor shall maintain all equipment in working condition and shall provide replacement due to breakdown, damage, or theft within two (2) work days. The Contractor's webcam system vendor shall proactively monitor the webcam system and if no system connection is made within normal working hours, not to exceed 24 hours, the vendor shall notify the Contractor and begin troubleshooting.

The Contractor shall remove all webcam system equipment and wood utility pole within ten (10) work days after the Engineer requests the removal in writing. The webcam system equipment and pole shall remain the property of the Contractor. The State shall retain ownership of all data collected by the webcam system.

The webcam system shall be operated in accordance with the "Policy for the Operation of Webcam Systems on Construction Contracts", a copy of which will be provided to the Contractor by the Engineer.

ITEM 637.4000nn20 - WEBCAM SYSTEM

METHOD OF MEASUREMENT

The webcam system will be measured for payment on a monthly basis, measured to the nearest 0.25 months.

BASIS OF PAYMENT

The unit price bid per month for the webcam system shall include the cost of all labor, materials and equipment, including services to provide, install, maintain and remove all components of the webcam system and wood utility pole. A deduction of 1/30 of a month will be made for each 24-hour period, or portion thereof during which the webcam system is not operational. Payment will begin the first month the webcam system is installed, operational and made available for use, including having the website established and functional. Monthly payments will be terminated no later than two (2) weeks after written notification by the Engineer that the webcam system will no longer be required.

ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

DESCRIPTION

This work shall consist of furnishing and installing the manual-dry Class 1 fire access pipe through a noise barrier in accordance with the Contract Documents and as directed by the Engineer. The requirements of the NFPA 502 “Standard for Road Tunnels, Bridges, and Other Limited Access Highways (2014 Edition)”, NFPA 14 “Standard for the Installation of Standpipe and Hose Systems (2013 Edition)”, and their associated referenced publications and the installation requirements of NFPA 13 “Standard for the Installation of Sprinkler Systems (2013 Edition)” and NFPA 24 “Standard for the Installation of Private Fire Service Mains and Their Appurtenances (2013 Edition)” shall be considered part of the requirements of this provision. The Contractor shall furnish five copies of the referenced NFPA Standards prior to installation, for use by the Engineer.

MATERIALS

Materials shall conform to the requirements of the following Subsections:

Miscellaneous Structural Reconstruction	586
Signs	645
Concrete Grouting and Anchoring Material	701-05
Anchoring Materials – Chemically Curing	701-07
Galvanized Coatings and Repair Methods	719-01

The Contractor shall be responsible for all material furnished under this item and shall replace, at his expense, all material found defective in manufacture or damaged in handling. Material shall be as specified in the Contract Documents and as follows:

Pipe and Fittings

All pipe, fittings, valves, and devices shall be UL 6 Fire Protection Directory (UL) listed or Factory Mutual Underwriters FM P7825 (FM) approved for fire protection service when supplied at a minimum of 300 PSI rated pressure and 200 PSI working pressure unless otherwise indicated.

Pipe shall be steel pipe, meeting the requirements of ASTM A53, Schedule 40, Grade A, Type F.

Fittings shall be as approved by the Engineer. All pipe threads shall conform to ANSI B1.20.1.

Provide technical data meeting system design based on maintaining minimum flow of 500 gallon per minute at 200 PSI working pressure with an additional 100 PSI surge loads. Working pressure limitations and pipe wall thickness shall be established by the coupling manufacturer based on listed tested assemblies.

Appurtenances

Fire Department Connections shall be constructed of components, and arranged and sized as

ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

indicated on the drawings. Single inlet Fire Department Connection fittings are large diameter, quick connection powder coated cast aluminum coupling with Storz inlet and female NPT outlet supplied with internal debris screen and aluminum cap with attachment chain.

Coatings

All pipe, fittings, and couplings, including their interior shall be galvanized in accordance with Specification Section 719-01.

Mounting Brackets & Hardware

Pipe hangers and supports shall be as shown on the drawings designed for dynamic thrust, static seismic, and wind support. All wall (shear) anchors for threaded rods or bolts shall installed in accordance with Specification Section 586, Miscellaneous Structural Reconstruction, and Specification Section 701-07, Anchoring Materials – Chemical Curing. Fully threaded rods, nuts, washers, and lock washers for anchors and wall supports shall be ASTM Type 316 stainless steel.

Any mounting brackets / hardware that is non-stainless steel shall meet the requirements of ASTM A36 grade structural steel or ASTM A575, Grade 1015 or 1020, and shall be galvanized in accordance with Specification Section 719-01.

CONSTRUCTION DETAILS

Construct fire access pipe at locations shown in the drawings and as shown in the details, and according to the following:

Fabrication

- A. Shop Drawings - Shop drawings and manufacturer's submittal data for the pipe, fittings, appurtenances, etc., will be required. Connections or attachments for the fire access pipe shall be shown in the appropriate shop drawings for the respective structural support elements.
- B. Welding - Welding, if necessary, shall conform to the provisions of the NYSDOT Steel Construction Manual (SCM). Weld inspection shall be done in accordance with the requirements of the SCM.
- C. Galvanizing
 - 1. Pipe and Supports

All non-stainless steel pipe and support elements shall be galvanized Type 1 and shall conform to the requirements of §719-01, Galvanized Coatings and Repair methods, unless otherwise noted. All holes and cutting of steel pipe support elements

ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

and bolting hardware is to be done prior to galvanizing. Pipe hangers shall be ordered plain steel to be galvanized as per §719-01, unless otherwise noted.

2. Bolts, Washers and Nuts

All non-stainless steel bolts, washers and nuts shall be galvanized Type 2 and shall conform to the requirements of §719-01, Galvanized Coatings and Repair methods. All bolts shall have a standard oversize tap to allow for the galvanizing on the bolts, washers and nuts.

- D. Coatings - The Contractor shall prepare and submit for approval a plan and/or procedure for the repair of damaged galvanizing, treatment of galvanized surfaces (if needed) and repair of coatings. Identify the cold galvanizing compound or other materials to be applied to repair damaged galvanizing and the material to be used to treat all galvanized surfaces (if required by the coating manufacturer). Include the manufacturer's name, product names, product numbers and product data sheets for each material.

Installation of Fire Access Pipe

A. Fire Access Pipe

1. Installation

Prior to installation, the contractor shall submit his erection method for the installation of the fire access pipe to the Engineer for his review.

2. Inspection

Immediately prior to installation, the Engineer shall inspect Fire Access Pipe components for damage that is attributable to improper storage of delivered components or shipping.

3. Noise Barrier Penetration

Contractor shall submit a procedure for coring holes in the existing / proposed noise barrier for approval by the Engineer. Any damage to the noise barrier panel during the installation process shall be repaired to the satisfaction of the Engineer.

Holes in the noise barrier shall be filled as shown in the Contract Documents with a material meeting the requirements of Specification Section 701-05, as approved by the Engineer. This shall only occur after the pipe has been firmly secured in place and deemed acceptable to the Engineer.

ITEM 663.95000004 – FIRE ACCESS PIPE AND LOCATION SIGN

4. Pipe Installation

The pipe shall be installed sloped uniformly (minimum of 1:50) to the low points and adjusted to eliminate potential undrained segments, and vertical segments shall be run plumb as shown in the Contract Documents or as directed by the Engineer. The Contractor is directed to follow the installation requirements outlined in NFPA 14 and the expanded descriptions in the associated NFPA 13, whichever is more stringent.

5. Fire Department Connections

Fire Department Connections shall be installed as shown in the Contract Documents and as approved by the Engineer and local Fire Marshall.

6. Mounting Brackets

Install mounting brackets with necessary bolts, rods, nuts, anchors, and other accessories as specified in the Contract Documents.

- B. Signs – Sign construction and installation shall conform to the requirements of Section 645, Signs, Standard Sheets Section 645, and as shown in the Contract Documents.

METHOD OF MEASUREMENT

This work will be measured on an each basis for satisfactorily completed work as indicated in the Contract Documents.

BASIS OF PAYMENT

The unit price bid for fire access pipe per each shall include the cost of furnishing all labor, materials, equipment, permits, approvals, and fees necessary to complete the work, including pipe, appurtenances, modifications to the noise barrier panel, mounting hardware, and signs per complete installation, to the satisfaction of the Engineer.

ITEM 680.80325010 - ALUMINUM MICROCOMPUTER CABINET BASE

DESCRIPTION.

Under this item the contractor shall furnish and install an aluminum microcomputer cabinet base at locations shown on the plans or as directed by the Engineer.

MATERIALS.

Materials for this work shall meet the requirements of the following subsections of Section 700 - Materials Details:

Base	Grade 5052-H32 Aluminum
Anchor bolts	723-60
Grouting	701-05

The base shall have full weld seams and shall conform in all respects to the attached drawing.

CONSTRUCTION DETAILS.

The cabinet base shall be fabricated and mounted on a concrete base in accordance with the details shown on the plans, standard sheets and as ordered by the Engineer. When the cabinet base is mounted on an existing foundation, the existing anchor bolts shall be removed as shown on the plans. Then the new anchor bolts shall be grouted into drilled holes as indicated on the plans.

METHOD OF MEASUREMENT

This work will be measured by the number of cabinet bases furnished and installed in accordance with the plans and specifications.

BASIS OF PAYMENT

The unit price bid for each cabinet base shall cover the cost of fabrication, installation, all labor, material and equipment necessary to complete the work.

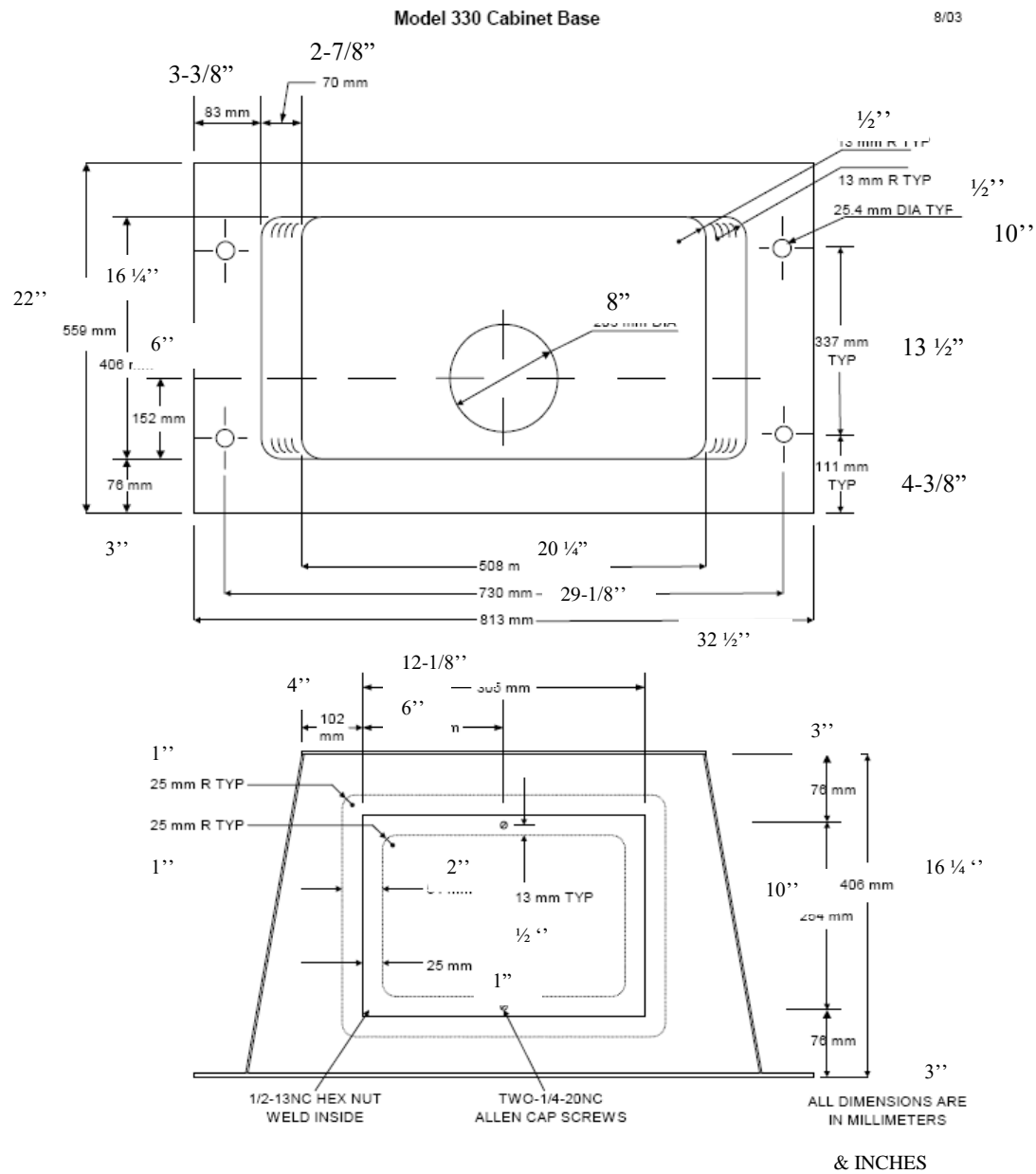
When the plans call for mounting the cabinet base on an existing foundation the cost of removing the existing anchor bolts and installing new anchor bolts shall be included in the price bid for this item.

When plans call for mounting the cabinet base on a new foundation, the installation of anchor bolts in the foundation shall be included in the price bid for this item.

New concrete foundations will be paid for under a separate payment item.

ITEM 680.80325010 - ALUMINUM MICROCOMPUTER CABINET BASE

ITEM 10680.803250 M - ALUMINUM MICROCOMPUTER CABINET BASE



**ITEM 680.94997008 – FURNISH AND INSTALL ELECTRICAL
DISCONNECT/GENERATOR TRANSFER SWITCH**

DESCRIPTION

Under this item, the Contractor shall furnish and install a electrical disconnect/generator transfer switch as shown on the contract documents, or the standard sheets or as directed by the Engineer.

MATERIALS

The Contractor shall furnish a electrical disconnect/generator transfer switch from a manufacture listed on the current New York State Department of Transportation Traffic Signal Laboratory's Qualified Product List.

CONSTRUCTION DETAILS

The electrical disconnect/generator transfer switch shall be attached to the pole or cabinet as shown on the contract documents or the standard sheet or as directed by the Engineer.

METHOD OF MEASUREMENT

This item will be measured for payment as the number of electrical disconnects/generator transfer switches furnished installed and accepted by the Engineer-in-Charge.

BASIS OF PAYMENT

The unit price bid shall include the cost of all labor, material and equipment necessary to complete the work as shown on the contract documents, on the standard sheets, or as directed by the Engineer.

ITEM 683.91150108 – MULTI LANE RADAR TRAFFIC DETECTOR

ITEM 683.91150208 – MULTI LANE RADAR TRAFFIC DETECTOR WITH EMBEDDED CAMERA

ITEM 683.91150408 – SOLAR OPTION FOR MULTI-LANE RADAR TRAFFIC DETECTOR

DESCRIPTION:

This work shall consist of furnishing and installing of Multi Lane Radar Traffic Detector, Multi Lane Radar Traffic Detector with Embedded Camera and the Solar Option for Multi-Lane Radar Traffic Detectors at the locations shown in the plans and as directed by the Engineer.

The sensor shall be a true presence type detector which can provide volume, lane occupancy, classification, and speed information on at least 12 discreet detection zones from a side-fire location. The detector information shall be available via an asynchronous serial communications line operated in a multi drop configuration. The collected information shall be made available to 3rd party systems and users whilst utilizing an open protocol.

If specified for installations not requiring a radar detector with embedded camera, the Solar Power option shall include solar power panels with battery back-up in accordance with the Plans or as directed by the Engineer. in accordance with the contract documents.

A set of documentation including solar power calculations, solar power system diagrams and component details, panel structure and mounting details and the battery backup enclosure details and schematic is required with each detector furnished.

MATERIALS:

All materials furnished, assembled, fabricated, or installed shall be new, corrosion resistant, and in strict accordance with the standards set by the New York State Department of Transportation (NYSDOT). The material shall contain all the components described in the subsequent material specifications. All necessary incidental components, cables, software/ firmware, hardware, and mounting attachments shall be supplied to accomplish a fully operational multi-lane radar unit installation. All equipment and component parts furnished shall be of the latest design, and manufacture. All parts shall be of high quality workmanship, and no part or attachment shall be substituted or applied contrary to the manufacturer's recommendations and standard practices.

The design life of all components, operating 24 hours per day, shall be ten (10) years minimum.

Radar Detector Requirements:

a. Radar Detector Unit

- The detector shall be mountable from a side fire location and shall comply with the limits of a Class A digital device pursuant to Part 15 of the FCC rules
- The unit shall not interfere with any known equipment
- The unit shall support at least 12 detection zones which can effectively cover 12 lanes of traffic within the range of 10 feet to 250 feet from the sensor, when the sensor is mounted at least 17 feet higher than the roadway profile
- The width and location of the detection zones shall be fully programmable via a PC or network interface, including Bluetooth interface.

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- The unit shall retain its programming in non-volatile memory
- Basic resolution of the unit shall be 1.5msec or less
- The reporting interval shall be user selectable within the range of 10 to 900 seconds in increments of ten seconds
- Support TCP/IP protocol
- Communication interface shall be Ethernet 10/100 Base T Auxiliary Communication interface shall be a RS-232/422 serial Data with a minimum operation rate of 9600 Bps.
- The unit shall support both contention and polled protocols. In contention mode, the unit shall report volume, average occupancy, and average speed over the reporting interval at the end of the interval. In polled mode, a communication address shall be assigned to the unit via its setup program. Upon receiving a command from the center with the appropriate address the unit shall respond with the accumulated volume, average occupancy, and average speed in the period since the last poll request was issued.
- Complete protocol descriptions shall be supplied with the submittal for the unit. These protocol descriptions shall be complete and adequate for the purpose of developing or supplying software to retrieve the information from the sensor, though an open protocol.
- Comply with NTCIP standard. The compliance Test certification shall be provided. All necessary third part hardware and software for NTCIP compliance shall be furnished and installed.
- Frequency: K band, 24 GHz
- Contact Closure: 12 Output for Vehicle present and Speed
- Unit Enclosure: Rugged NEMA 4X or IP 67 rated
- Power: 12-24 VDC, Max 5 Watts, Multi Lane Radar Traffic Detector; or
- Power: 12-24 VDC, Max 15 Watts, Multi Lane Radar Traffic Detector with Embedded Camera
- Surge protection (power and data) shall comply with IEEE Standard 587-1980 Category C.
- Operating Temperature: -40°F to +165°F
- Operating Wind : Up to 120 Mph
- Humidity: 5 to 95%, non-condensing

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- Weather: Rain or snow up to 4 inches per hour.
- Vibration: 2 g up to 200 Hz sinusoidal.
- Shock: of 5 g 10 millisecond half sine wave
- Data Measurement Accuracy:
 - Volume Measurement - Maximum +/- 5% difference from actual count for a 5 min period
 - Occupancy - Maximum +/- 10% difference from actual measurement by a 6' loop for a 5 min period
 - Speed - Maximum +/- 10% difference from actual speed or radar gun speed measurement for averaging in a 5 min period.
 - Classification - The unit shall be able to differentiate long from short vehicles as:
 - i. FHWA Classification Class 1-3,
 - ii. FHWA Classification Class 4
 - iii. FHWA Classification Class 5-7,
 - iv. FHWA Classification Class 8-10
 - v. FHWA Classification Class 1-13
- Data measurement accuracy test shall be performed by the Regional TMC.
- The Radar Unit design shall be inherently temperature compensated to prevent abnormal operation. The circuit design shall include such compensation as is necessary to overcome adverse effects due to temperature in the specified environmental range. The unit shall not require programming changes to compensate for different environmental conditions encountered from season to season.

b. Mounting Hardware

The radar detector shall be supplied with a mounting bracket. The mounting bracket shall be designed to allow the detector to be mounted on a pole type structure and shall utilize a ball-joint. The ball joint shall be equipped with a locking pin which will allow the detector to be mechanically aimed and secured in place. The ball joint will allow the unit to be tilted in both directions. The mounting bracket shall be supplied with stainless steel bands which will allow the unit to be attached to poles ranging from 1 to 20-inch diameter. The mounting hardware shall have a marker for the detector position setting. The appropriate size band shall be supplied for the pole designated in the plans to which the unit will be mounted. The mounting bracket shall be able to marked mounting position for future used and it should be adjustable in three axes.

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c. Power Supply

The Radar detector unit shall supply with power supply 120 VAC to 12-24 VDC. The power supply shall be rugged unit AC Power Supply with following requirements:

- UL508 listed
- Installed on DIN rail or shelf (with mounting hardware)
- AC input range: 85~264vac
- Operating temperature range: -40°F to +165°F
- Fully isolated case to prevent users from hazardous shock
- Standard Protections: short circuit / over load / over voltage
- LED indicator for power on
- Low no load power consumption: <0.75W
- Maximum Power: 10 Watt, Multi Lane Radar Traffic Detector; or
- Maximum Power: 25 Watt, Multi Lane Radar Traffic Detector with Embedded Camera

d. Diagnostic Software

A PC based diagnostic software package shall be provided which can operate under Windows 7 or latest version. The diagnostic program shall fully support the programming of all parameters in the unit including type of protocol and detection zones. The program shall also display in real-time presence in the programmed detector zones and shall also report the accumulated data over the reporting interval for all programmed zones including volume, average occupancy, and average speed. The software shall be access to the radar detector unit via Ethernet, Serial Data interface, Bluetooth connection and via a network for remote diagnostic.

e. Radar unit Power Polarity Protection

f. Cables and Connectors

The Radar Unit connector shall be a single, MIL-C-26482 II MS connector or equivalent as approved by the Engineer. The terminated cable shall support:

- Rugged Ethernet Cable
- Power Cable
- Contact Closures Cable
- Serial Data Cable
- Ground Wire

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g. Integrated Bluetooth communication for remote setup, calibration, and data retrieval

h. Embedded Camera

The Multi Lane Radar Traffic Detector with Embedded Camera shall be equipped with a HD fixed Charged-Coupled Device (CCD) camera for visual verification of the detector site. The CCD camera shall have:

- Video Resolution: 1280 x 720, 704 x 576, 640 x 352, 320 x 192
- Video Compression: H.264
- Compression Rate: Variable Bit Rate (VBR) and Constant Bit Rate (CBR) from 512Kb/s to 5Mb/s
- Video Frame Rate: 1 to 30 frames per second
- Video Snapshot: JPEG
- Streaming Format: Real Time Streaming Protocol (RTSP) with support for two (2) independent streams
- Adjustment of Video: Brightness, contrast, saturation, sharpness and image quality via web browser
- Security: Password protected user interface
- Onboard flash video and image storage and retrieval

i. Labeling

All conductors and cables shall be labeled. Labels attached to each end of the conductor/Cable shall identify the destination of the other end of the conductor/ cable. The Label material shall be resistant to degradation from UV rays, heat and cold. The contractor shall submit a sample of proposed labels to the Regional TMC for review and approval. The label information shall match exactly with Field Equipment Cabinet wiring and equipment layout.

j. Workmanship

Workmanship shall conform to the requirements of this specification and be in accordance with the highest industry standards.

k. The Radar Unit cables shall be furnished and assemble with Data, Power and Ethernet surge protection units. All surge protectors shall be UL listed and be applicable for outdoor application use.

OPTIONAL

Solar Power:

The field equipment shall employ solar powered battery backed power for the sensor, solar controllers with under voltage disconnect and any other ancillary equipment. The solar controller

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shall display the array voltage, battery voltage, charging current and shall have an Ethernet communication port. The capacity of the solar collector and battery shall be sized by the contractor to ensure a minimum of 7 days of continuous operation between charge cycles due to inclement weather. The contractor shall provide the solar system calculations with a minimum of the following:

- Solar system load calculations with 25% minimum contingency power.
- Solar panel power calculations based on the actual system location.
- Solar system efficiency calculation.
- Back up battery sizing calculations, using wintertime temperature conditions.
- Panel and enclosure mounting details.
- Solar system component block diagram.
- Solar system component wiring diagram.
- Solar system monitoring application (system status, power level, battery status, maintenance alarm).
- Solar system testing plan.
- Panel mounting details.

All equipment, including batteries, regulator, and desulfanator shall be installed in a suitably sized NEMA 3R enclosure for roadside mounting.

CONSTRUCTION DETAILS:

The Multi Lane Radar Traffic Detector shall be mounted in Side-fired configuration on poles or sign structures at the specified locations as shown on the contract documents. The Radar Detection unit shall be mounted using the manufacture approved mounting bracket. The bracket shall be attached with NYSDOT approved stainless steel bands with minimum of; 3/4-inch wide and 0.05-inch thick. The Contractor shall submit the details of the mounting hardware for any installation of the Multi Lane Radar Traffic Detector on a concrete wall, bridge or structure. The mounting hardware and installation shall comply with NEMA TS2-2003 specifications. The Radar Unit shall be installed on the poles or structure as shown on the plans along with conduit fittings necessary to bring cables to a field equipment cabinet.

The Contractor shall also furnish and install all solar power equipment, including but not limited to solar panels, batteries, cabinets and associated wiring.

Prior to the installation, the Contractor shall submit the Multi Lane Radar Traffic Detector wiring schematic, configuration (including detector zone) and mounting details for each location to the Regional TMC for review and approval. The submitted drawings shall detail the exact placement of each radar unit showing the height the unit is mounted at, the proposed detection zone and hardware mounting methods. These drawings shall also include details of the installation of a shielded outdoor rated communications cable from the radar unit to the field equipment cabinet, including the installation of the Ethernet, power and auxiliary cables harness used for installation

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and alignment of the radar unit. The submitted details should include the unit configuration and programming tools, detection zone per each location, setting parameters, communication setting details, and interconnection to the Regional TMC network. This submission should be made 30 days prior installation date of Multi Lane Radar Traffic Detector. The schematic shall depict the wiring required for the radar unit, its complements and other equipment, which necessary for the operation.

No Multi Lane Radar Traffic Detector shall be installed without an approved schematic, configuration and mounting details. Upon request from the Regional TMC, the contractor may be required to perform a field demonstration of the assembly at a particular site which would be intended for approximating the conditions under which the sensor will need to operate for the project.

Utilizing factory trained personnel, the mounting bracket shall be mounted at the optimum height on the assigned pole. With the use of a bucket truck or secured ladder, the assembly shall be physically pointed to provide optimum coverage for the travel lanes indicated on the plans to be covered. Once mechanically aimed, the detection zone shall be optimum using the radar unit software tools. In addition, the Contractor should coordinate with the regional TMC for IP, VLAN and port assignment and program the radar unit communication interfaces. A radar gun shall be available for determining typical speeds on the approach to all detection zones at the time that the assembly is mounted. This speed shall be provided to the diagnostic program for calibrating speed measurements obtained for the assembly, the captured data shall also be recorded within the Site Acceptance documentation which will be passed to the Regional TMC Engineer. Once programmed, a test shall be conducted verifying volume measurements against manual counts and speed measurements against radar gun observations and other measurement as per the Regional TMC direction. The unit shall operate within the tolerances included in the material specifications for volume, occupancy, speed and classification.

The contractor shall submit a copy of the field office Electrical inspection and acceptance to the Regional TMC.

Documentation:

Submittal of two Multi Lane Radar Traffic Detector/ Multi Lane Radar Traffic Detector with Embedded Camera Drawing Packages shall be sent to the Regional TMC for review and approval. These submittals are:

A. Radar Unit Assembly Submittal - The contractor shall provide this submittal a minimum of 30 days prior to the installation of the unit to the Regional TMC Engineer for review and approval. The cabinet assembly drawings package shall include but not limited to:

- Equipment Manufacturer's Cut Sheet and Manuals
- Radar Unit Mounting Layout (structure type, hardware attachments, all physical dimensions and assembly details shall be included)
- Radar Unit interconnection to a Field Equipment Cabinet Details

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- Radar Unit all power, grounding, communication, contact closure signal control wires and auxiliary Wiring Diagrams (as required all calculation shall be included)
- Radar Unit and its accessory equipment, cables and wiring labeling details
- Radar Unit Detection Zone details (picture and dimensions for each zone)
- Radar Unit Configuration Details
- Video Setting and Configuration Details
- Radar Unit Diagnostic and programming tools cut sheet and two copy of the software (all third party software necessary for the diagnostic/programming of the unit shall be provided)
- Manufacture product test certificate

B. Final Radar Unit Drawing Package - The final Radar Unit Drawing Package shall be approved by Regional TMC Engineer prior to final acceptance of the Multi Lane Radar Traffic Detector/ Multi Lane Radar Traffic Detector with Embedded Camera. The final radar unit drawing package shall be submitted 60 days prior the project closing date to Regional TMC for review and acceptance. If the submittal will not be accepted, the contractor shall respond to the comments and resubmit the final Radar Unit drawing package. The Radar Unit drawings package shall include but not limited to:

- Equipment Manufacturer's Latest Manuals and application notes
- Radar Unit connection to the field equipment cabinet and power source including junction boxes, pull boxes and cables Location Layouts
- Radar Unit Assembly Layout (all physical dimensions and assembly details shall be included)
- Radar Unit Cabinet Mounting details (including structure type, height, angels, bracket, adjustment hardware mounting details)
- Radar Unit Detection Zone Placement/Layout
- Radar Unit all power, grounding, communication, contact closure signal control wires and auxiliary Final Wiring Diagrams (as required all calculation shall be included)
- Radar Unit Final Configuration Details
- Radar Unit Diagnostic and programming tools and four copies of the latest software (all third-party software necessary for the diagnostic/programming of the unit shall be provided with required Licenses)
- Licenses, All necessary licenses for full operation of the Multi Lane Radar Traffic Detector/ Multi Lane Radar Traffic Detector with Embedded Camera.
- Radar Unit Remote Final connection to the Regional TMC Network Diagram
- Radar Unit Test Plan and Test Results

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- Radar Unit and its accessory equipment, cables and wiring labeling Final Details
- Solar power system calculations
- Solar power system block and wiring diagrams.
- Manufacturer product test certificates.

All drawings shall be 11" x 17" size. All drawing shall be submitted in hard copy, electronic, and CADD/Microstation (latest version used by NYSDOT) formats.

Multi Lane Radar Traffic Detector/ Multi Lane Radar Traffic Detector with Embedded Camera Acceptance Test:

The Radar Unit testing shall be performed after complete installation of all equipment and cables and power and communication service connection to the Radar Unit and completion of the Field Office Electrical Inspection. This test shall include the following items:

Radar Unit testing requirements:

1. Verify the approved Radar Unit Layout Drawing matches the physical layout of the Radar Unit per site (Radar unit height, covering lane, cabling distance, mounting attachment and assembly).
2. Verify the approved Radar Unit Wiring Drawing matches the physical wiring of the cabinet
3. Verify the approved Radar Unit equipment/accessories list matches the Radar Unit assembled equipment
4. Verify the Power Voltage, Current and power consumption Wattage of the Radar Unit (average measurement in a minimum period of 10 minutes)
5. Check and Verify the Radar Unit Configuration- Detection Zones
6. Check and Verify the Radar Unit Configuration- Communication Connection
7. Check and Verify the Radar Unit Configuration- Setting Parameters
8. Check and Verify the Radar Unit Configuration- Video Quality and setting
9. Check the Radar Unit Communication ports and Contact closure Terminal connection and wiring
10. Check the Radar Unit ground connections to the Site/Field Equipment Cabinet grounding
11. Check the Surge Protectors installation
12. Check the Bluetooth remote connection.
13. Check the Contact Closure activation on present of vehicle
14. Check the Traffic Count in a 10 minutes interval per each Volume Detection Zone (Compare with manual counting)

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15. Check the Traffic Speed in a 10 minutes interval per each Speed Detection Zone (Compare with Radar gun or as per measurement directed by the Regional TMC)
16. Check the Radar Unit equipment and wiring labels
17. Check the Radar unit field equipment cabinet interface equipment mounting or placement on shelves. All equipment should be in safe, fix on the shelf (with a mounting bracket or hardware) and be in a secure position.
18. Checking the Radar Unit conduit type and installation. All conduit entries should be sealed with an adequate plug to prevent rodent intrusion. All Expose conduit shall have label.
19. Check the Radar Unit cables Slack in the field equipment cabinet. (Slack length as per the Regional TMC direction)
20. Check the Radar Unit assembly and its cable and wiring installation workmanship
21. Check the Radar Unit ID label installation

The contractor shall submit the test forms, procedure and schedule to the Regional TMC for review and approval. The testing shall be coordinated with the Regional TMC and a witness from the Regional TMC shall be present during the testing. The accepted test forms shall be signed by the Contractor, Project Field Office representative and the Regional TMC representative.

Solar Power System Acceptance Test:

The contractor shall submit the test forms, procedure and schedule to the Engineer for review and approval. The testing shall be coordinated with the Regional TMC and a witness from the Regional TMC shall be present during the testing. The accepted test forms shall be signed by the Contractor, Project Field Office representative and the Regional TMC representative. The test plan shall include the electrical, mounting/mechanical, panel, batteries and safety items. The test plan shall have the check list with a list of all testing equipment.

WARRANTY:

The Contractor shall provide warranties and guarantees to the State of New York Department of Transportation in accordance with Article 104-08 of the Standard Specifications.

METHOD OF MEASUREMENT:

Each Multi Lane Radar Traffic Detector will be measured as the number of complete units furnished, installed and tested.

Each Multi Lane Radar Traffic Detector with Embedded Camera will be measured as the number of complete units furnished, installed and tested.

Each Solar Option for Multi-Lane Radar Traffic Detector will be measured as the number of complete assemblies furnished installed and tested.

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BASIS OF PAYMENT:

The unit price bid for each Multi Lane Radar Traffic Detector or Multi Lane Radar Traffic Detector with Embedded Camera shall include the cost of furnishing all labor, materials, tools, pedestal, equipment and incidentals as necessary to complete the work.

Progress payments will be made as follows:

Twenty Five percent (25%) of the bid price of each item will be paid upon satisfactory completion and approval of the of Field Radar Unit Assembly Submittal, Sixty percent (60%) will be paid upon satisfactory completion of Multi Lane Radar Traffic Detector/ Multi Lane Radar Traffic Detector with Embedded Camera Test; Fifteen percent (15%) will be paid upon satisfactory completion of 90-Day Operational Test Multi Lane Radar Traffic Detector/ Multi Lane Radar Traffic Detector with Embedded Camera.

Payment will be made under:

Item No.	Item	Pay Unit
683.91150108	Multi Lane Radar Traffic Detector	EACH
683.91150208	Multi Lane Radar Traffic Detector with Embedded Camera	EACH
683.91150408	Solar Option for Multi-Lane Radar Traffic Detector	EACH

**ITEM 683.96051804 – GALVANIZED CAST IRON SURFACE MOUNTED
JUNCTION BOX WITH HINGED COVER, SURFACE
MOUNTED, 18 IN (H) x 18 IN (W) x 12 IN (D)**

DESCRIPTION

Under this item the Contractor shall furnish and install galvanized steel junction boxes with hinged covers for the purpose of providing conduit junction points, pull points, and splice locations for fiber optic cables as shown on the contract plans.

MATERIALS

The cast junction box shall be watertight in accordance with NEMA Type 4 specifications and shall be protected against corrosion with hot dipped galvanization that conforms to ASTM A153-73, Class A and NEMA requirements.

Box shall be furnished with stainless steel screws, cast iron cover, and neoprene gasket. The cast iron cover shall be equipped with a minimum of two (2) factory installed stainless steel hinges.

Unless otherwise determined by manufacturer, a minimum of 4 mounting lugs per box shall be required for installation.

CONSTRUCTION DETAILS

Contractor shall have the option of using either a factory drilled and tapped hole or slip hole as an acceptable conduit entry method.

Contractor shall attach box to structure with approved supporting hardware at location(s) as shown on the contract plans. Orientation of hinged cover shall be as shown on the contract plans.

METHOD OF MEASUREMENT

The quantity to be paid for under this item will be the number of complete junction boxes installed.

BASIS OF PAYMENT

The unit price bid shall cover the cost of the junction boxes including conduit connection hardware, incidentals, labor, equipment, and all other materials necessary to complete the work.

ITEM 800.01000015 – DESIGN BUILD – DESIGN SERVICES

DESCRIPTION. This work shall consist of providing design services in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall provide Design Services by the appropriately qualified and licensed personnel in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build - Design Services will be measured for payment on a lump sum basis.

BASIS OF PAYMENT. The lump sum price bid for Design Build - Design Services shall include the cost of furnishing all labor, equipment and incidentals to satisfactorily complete the work. Progress payments will be made in accordance with the contract documents.

ITEM 800.02000015 – DESIGN BUILD – CONSTRUCTION INSPECTION SERVICES

DESCRIPTION. This work shall consist of providing Construction Inspection Services in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall provide Construction Inspection Services by the appropriately qualified and licensed personnel in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build - Construction Inspection Services will be measured for payment on a lump sum basis.

BASIS OF PAYMENT. The lump sum price bid for Design Build - Construction Inspection Services shall include the cost of furnishing all labor, equipment and incidentals to satisfactorily complete the work. Progress payments will be made in accordance with the contract documents.

ITEM 800.03000015 – DESIGN BUILD – QUALITY CONTROL SERVICES

DESCRIPTION. This work shall consist of providing Quality Control Services in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall provide Quality Control Services by the appropriately qualified and licensed personnel in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build - Quality Control Services will be measured for payment on a lump sum basis.

BASIS OF PAYMENT. The lump sum price bid for Design Build - Quality Control Services shall include the cost of furnishing all labor, equipment and incidentals to satisfactorily complete the work. Progress payments will be made in accordance with the contract documents.

ITEM 800.0400NN15 – DESIGN BUILD – EXTRA WORK

DESCRIPTION. This work shall consist of performing work in accordance with the contract documents and as directed by the Department's Project Manager. This item provides a contract contingency allowance for the timely payment of authorized extra work.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall perform work in accordance with the contract documents and as directed by the Department's Project Manager. The Design Builder shall maintain and submit Agreed Price Work or Force Account Work records in accordance with DB section 109-05 *Extra Work and Time Related Compensation*.

METHOD OF MEASUREMENT. Design Build – Extra Work will be measured for payment on a Dollar Cents basis.

BASIS OF PAYMENT. The price shown for Design Build - Extra Work shall include the cost of furnishing all labor, materials, and equipment necessary to satisfactorily complete the work. The total cost shown in the price proposal will be considered the price bid even though payment will be made only for actual work performed. The unit price amount is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figure will be disregarded, and the original price will be used to determine the total amount bid for the contract. Progress payments will be made in accordance with the contract documents.

Note: NN in pay item number denotes serialization.

ITEM 800.05000015 – DESIGN BUILD – SITE MOBILIZATION

DESCRIPTION. This work shall consist of providing necessary bonds, insurance, prefinancing and set up of necessary general plant, including shops, storage areas, office and such sanitary and other facilities as are required by local or state law or regulation.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall provide the above facilities and service for mobilization in a safe and workmanlike manner in conformance with any pertinent local or State Law, regulation or code to the extent and at the time the Contractor deems them necessary for its operations. Good housekeeping shall be maintained.

METHOD OF MEASUREMENT. Design Build – Site Mobilization will be measured for payment on a lump sum basis.

BASIS OF PAYMENT. The lump sum price bid for Design Build – Site Mobilization shall not exceed four percent (4%) of the total contract bid price for all Construction Work items. Should the bidder exceed the foregoing four percent (4%), the Department will make the necessary adjustment to determine the total amount bid based on the arithmetically correct proposal.

Progress payments in the amount of 4% of the construction work items will be made to the Contractor with the first contract payment made for other contract work at the individual itemized work site.

ITEM 800.0600NN15 – DESIGN BUILD – CONSTRUCTION WORK

DESCRIPTION. This work shall consist of construction work in accordance with the contract documents.

MATERIALS. None Specified.

CONSTRUCTION DETAILS. The Design Builder shall perform all construction work in accordance with the requirements in the contract documents.

METHOD OF MEASUREMENT. Design Build – Construction Work will be measured for payment on a lump sum basis for each location. The individual locations are identified in the contract documents.

BASIS OF PAYMENT. The lump sum price bid for Design Build – Construction Work shall include the cost of furnishing all labor, materials, equipment, management and supervision to satisfactorily complete the work. Progress payments will be made for each construction work location in accordance with the contract documents.

Note: NN in pay item number denotes serialization by location.